Empire (1998)

DEVELOPMENT AND IMPLEMENTATION PLAN APPLICATION

For The
MEADOWLANDS MILLS PROJECT

Submitted to the
Hackensack Meadowlands Development Commission

Submitted by
Empire, Ltd.

June 12, 1998

This Development and Implementation Plan Application has been prepared in four distinct Volumes, as listed below. Although each Volume is contained in separate binders, information related to the Development Plan and Implementation Plan application is contained and referenced throughout the four Volumes. In addition, a set of drawings (site plans) for both the Development Plan and the Implementation Plan portions of the Application are enclosed with these Volumes as part of the overall Application submission.

VOLUME A	**Development and Implementation Plan Application**
VOLUME B	**Responses to Conditions and Findings**
VOLUME C	**Environmental Impact Assessment Report**
VOLUME D	**Environmental Impact Assessment Report Appendices**

I. EXISTING ENVIRONMENTAL CONDITIONS ON-SITE

I. EXISTING ENVIRONMENTAL CONDITIONS ON-SITE

A. PURPOSE AND METHODOLOGY

Section I of this Environmental Impact Assessment Report (EIAR) provides an inventory and discussion of existing environmental conditions of the project site and surrounding areas. The natural environment as well as the human environment is addressed. The purpose of this discussion is to characterize the site and its surrounding environment so that potential impacts of the proposed project can be anticipated and investigated.

The proposed Meadowlands Mills development would be located on the 584-acre Empire tract in Bergen County, New Jersey, within the Hackensack Meadowlands District (HMD). The majority of the property is within the borough of Carlstadt; small portions are within the township of South Hackensack and the borough of Moonachie. Teterboro Airport is located approximately 1.5 miles northwest of the Empire tract.

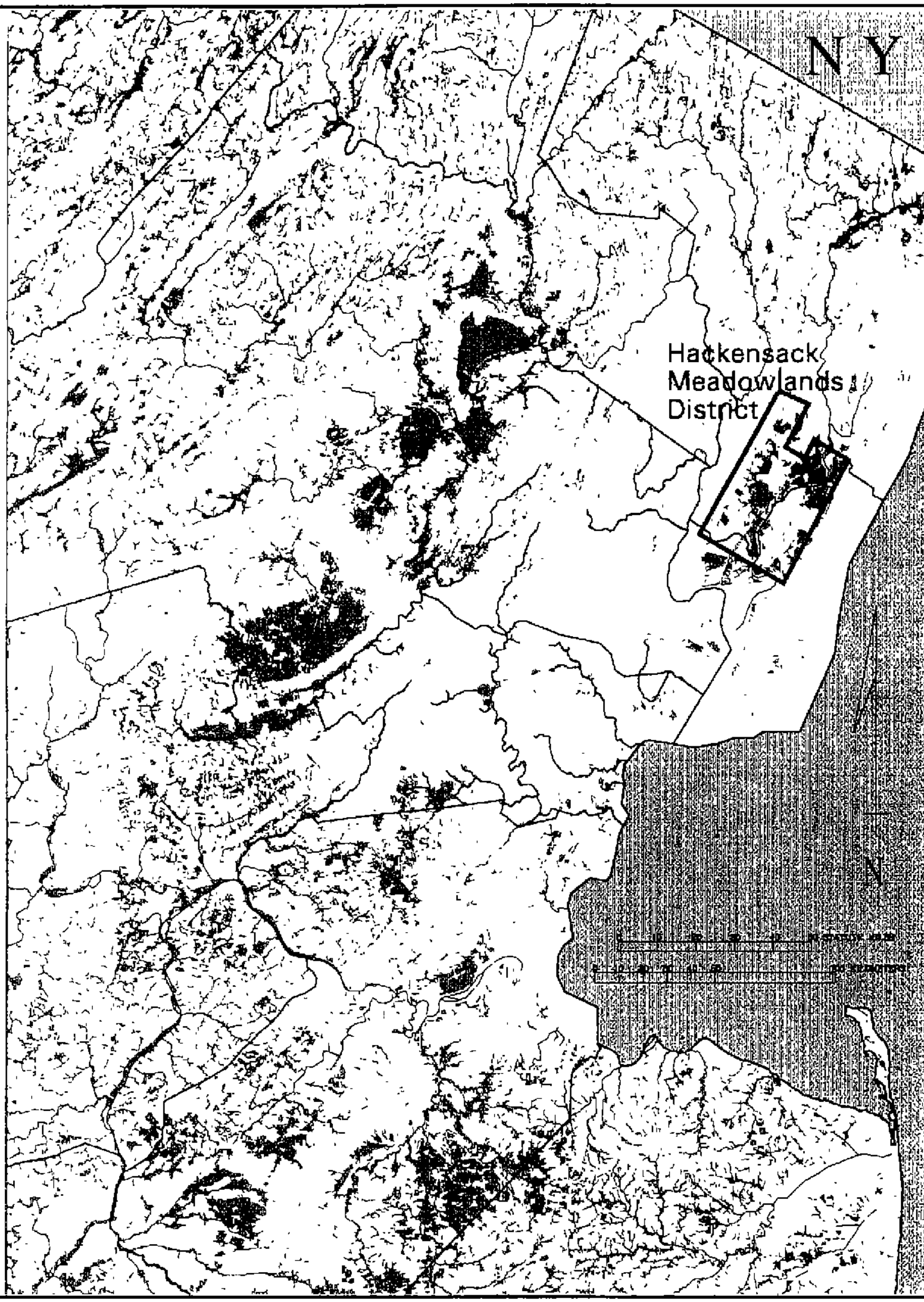
The proposed development is subject to the jurisdiction of the Hackensack Meadowlands Development Commission (HMDC), a state-appointed authority governing land use in a district encompassing approximately 20,000 acres, portions of 14 municipalities, and 2 counties. A nationally recognized agency, HMDC is dedicated to wetlands protection and has endeavored to balance this goal with social and economic needs in the HMD.

The project would be a mixed-use development comprised of a combination of interrelated elements including retail/entertainment center, hotel, office center, related road systems, multi-decked parking garages, and a mass transit facility. The development would result in the filling of approximately 199 acres of wetlands on the Empire tract.

Wetland mitigation, comprised of separate freshwater and brackish marshes, is a major component of the Meadowlands Mills project. These wetland systems would consist of the enhancement, preservation, and creation of wetlands on approximately 379 acres of predominately dry existing marshland. The mitigation would enhance the current ecological value of the unfilled portion of the Empire tract, resulting in no net loss of wetland values.

In New Jersey, wetlands have been estimated to compose approximately 19 percent of the state (or 900,000 acres) (Robichaud, Collins and Anderson, 1994). Wetlands are classified by the type of vegetation and soils present, and the water saturation condition. In northern New Jersey, several types of wetlands occur, including freshwater marshes, coastal salt marshes, swamps, floodplains, and peatlands (bogs and fens). Figure I.A-1, Existing Wetlands of Northern New Jersey, details the occurrence of wetlands in the northeastern part of the state, based on data collected by the New Jersey Department of Environmental Protection (NJ DEP).

Existing Wetlands of Northern New Jersey



Wetlands

Source: New Jersey Department of Environmental Protection

Figure I.A-1

As can be seen on Figure I.A-1, there are numerous wetland areas in northern New Jersey. The large wetland area to the west of the HMD is the Great Swamp. Like the HMD, the Great Swamp was formed as a result of the retreat of a glacial lake, Glacial Lake Passaic. For the purposes of this report, descriptions in terms of regional context will pertain to the HMD as delineated in Figure I A-2, Existing Wetlands in the Hackensack Meadowlands District.

The general environment of the HMD has been extensively described in the DEIS for the SAMP (USEPA and USACE, 1995). The SAMP is a comprehensive plan providing for natural resource protection, remediation of pollution, and reasonable economic growth for the HMD. Due to centuries of modification to the general environment, a broad range of environmental problems have compromised the quality of natural resources in the HMD. These modifications include impoundment of the Hackensack River, use of wetlands for waste disposal, and human settlement, involving extensive diking and ditching.

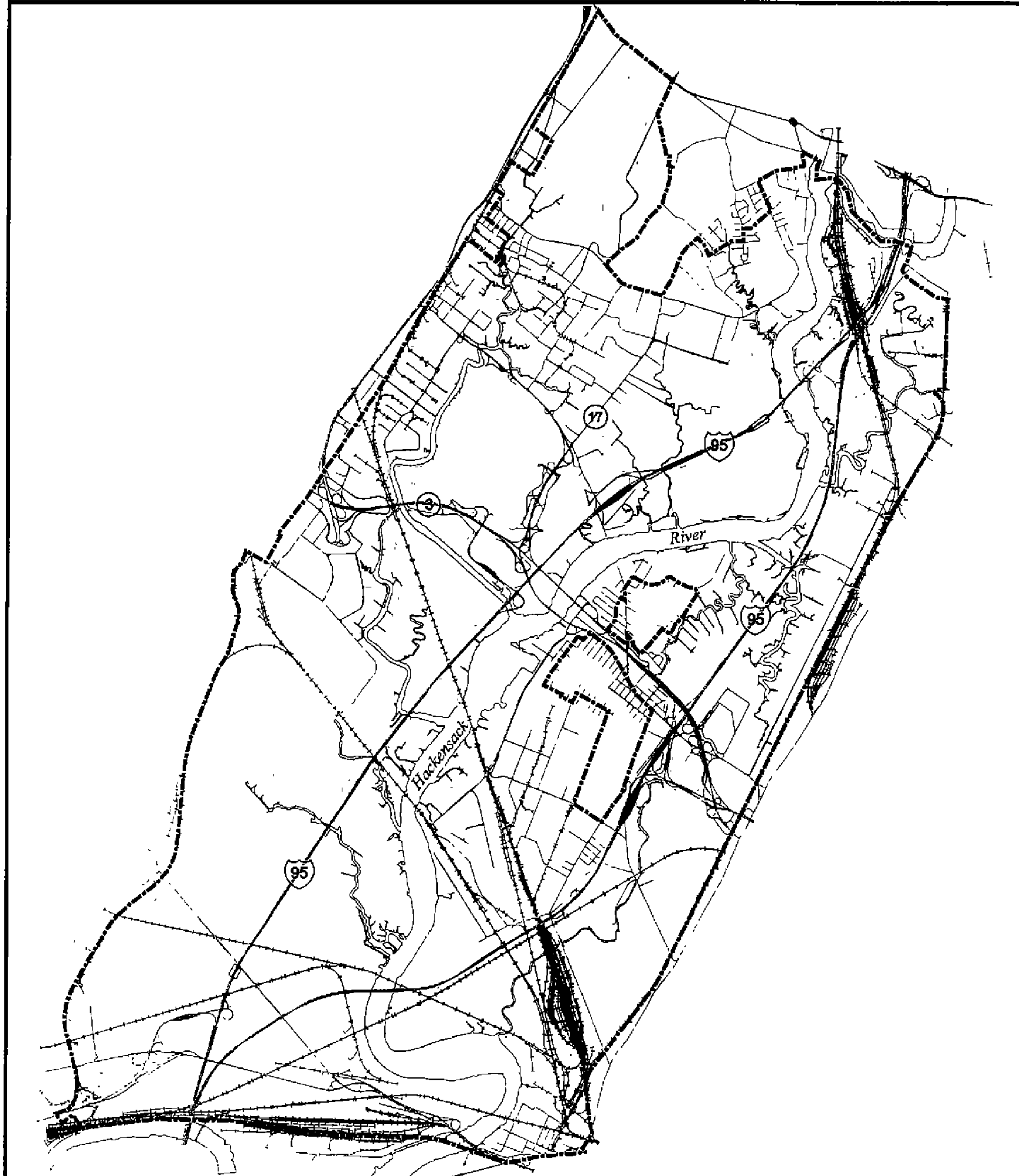
According to the DEIS for the SAMP (USEPA and USACE, 1995), "the legacy of pollution and environmental destruction from previous decades of waste disposal within the HMD is apparent. Planning for the future of the HMD needs to recognize the remediation costs of existing long-standing, cumulative, and secondary impacts on wetlands and uplands areas." To restore and enhance the natural environment of the HMD, the SAMP agencies have developed an Environmental Improvement Program (EIP) which is an integral component of the SAMP and the proposed HMDC Master Plan.

As discussed in the DEIS for the SAMP, the substantial cost of environmental remediation, estimated by the HMDC to be as much as $900 million, has not been within the resources of the HMDC or other governmental agencies. Various funding mechanisms, however, have been proposed that "rely on the enhanced value of projects that are consistent with the SAMP/HMDC Master Plan."

The EIP would provide a centrally-managed approach to environmental remediation and natural resources protection projects throughout the HMD. It proposes specific environmental objectives including habitat improvements, enhancements, and remediation programs for the HMD's environment and surrounding regions. The major environmental issues in the HMD that the EIP is designed to address are:

- Solid waste management;
- Water resource protection;
- Flood control;
- Contaminated land reclamation;
- Natural resource management, including wetlands enhancement;
- Parks and recreation;
- Air quality,
- Historic and cultural resources; and
- Environmental enforcement.

Existing Wetlands in the Hackensack Meadowlands District



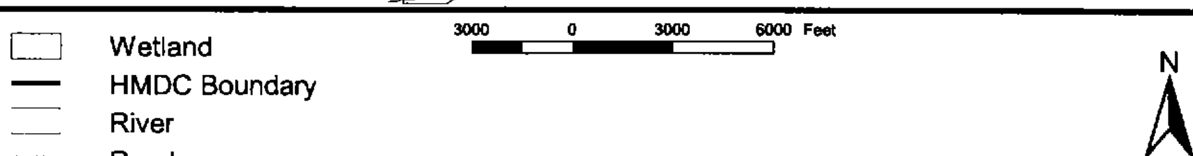


Figure I.A-2

Each of these issues is discussed in detail in Section 2 and Appendix C of the DEIS for the SAMP (USEPA and USACE, 1995). The long-term goals of the EIP include the "enhancement, restoration, and management of the natural resources of the Meadowlands ecosystem, increasing its biological diversity, and functioning for the benefit and appreciation of future generations."

Wetlands and aquatic habitats in the HMD are comprised of approximately 3,400 acres (40 percent) publicly-owned land and 5,100 acres (60 percent) of private or quasi-publicly held lands (USEPA and USACE, 1995). The Empire tract is privately owned. Through utilization of the EIP and the SAMP, the HMDC would plan, implement, and enforce "a comprehensive wetland enhancement and management program funded by a variety of private and public sources [designed to] strengthen the approach to wetland enhancement and management currently applied by federal and state agencies." The Meadowlands Mills project proposed herein, including the proposed mitigation, would contribute substantially to meeting these goals.

B. LOCATION AND PHYSICAL CHARACTERISTICS OF THE SITE

1.0 Location and Topography

The total Empire tract is comprised of approximately 584 acres of currently undeveloped land located in the Hackensack Meadowlands District (HMD), Bergen County, New Jersey. Two parcels of land comprise the Empire tract: a 542-acre parcel and a 42-acre parcel. Regionally, the topography of surrounding southwest Bergen County is diversified and includes a wide variety of natural and man-made features (See Figure I.B-1, Existing View of Meadowlands Mills).

One of the most prominent natural features of the area is the ridgeline that goes through nearby Carlstadt, Wood Ridge, and Hasbrouck Heights to the northwest, and runs along Hackensack Street and Terrace Boulevard parallel to State Highway Route 17. In this area, elevations are around 200 feet (ft) National Geodetic Vertical Datum 1929 (NGVD). Approximately 2.0 mi to the east, the Palisades diabase sill rises to elevations around 250 ft NGVD prior to dropping dramatically to the Hudson River. The Hackensack River Valley between these high grounds is level and includes: the HMD; the town of Secaucus; the Meadowlands Sports Complex; a regional network of highways and rail; the Empire tract; and, to the north, Teterboro Airport.

Light industrial development is the predominant land use west of the Empire tract. Elevations in the industrial area range from 2 ft NGVD along the site boundary to 25 ft NGVD along a small ridge located in the vicinity of Washington Avenue.

The existing topographic relief across the 542-acre parcel generally varies between 0 and 5 ft NGVD, with creeks and mosquito ditches meandering throughout. The 42-acre parcel varies in relief from 0 to 15 ft NGVD, and has a small portion of uplands adjacent to the Outwater Lane embankment and the Barge Club restaurant.

Two major dikes, or berms, that are parallel with the Hackensack River are located on the parcels. One dike on the 42-acre parcel is adjacent to the Hackensack River and extends from the marina at the end of Outwater Place to the tide gate at Moonachie Creek. The other dike, which is on the 542-acre parcel, runs adjacent to the southwest bank of a man-made channel which carries some of the flow from the adjacent Losen Slote to the Hackensack River. These berms, and the Transco access road, range from approximately ten to 20 ft wide at the top, and from approximately 40 to 60 ft wide at the base. The elevation of the top of the berms typically varies between elevation 5 and 6 ft NGVD.

The two portions of the Empire tract are separated by the NJ Turnpike's Western Spur, which is elevated with an embankment approximately ten ft above the on-site marsh. The elevation of the marshland across the Empire tract where there is *Phragmites australis* typically varies between elevation -1 and 2 ft NGVD. A viaduct, which begins about 1,000 ft southwest of the shoreline, carries the turnpike over the Hackensack River.

Existing View of Meadowlands Mills

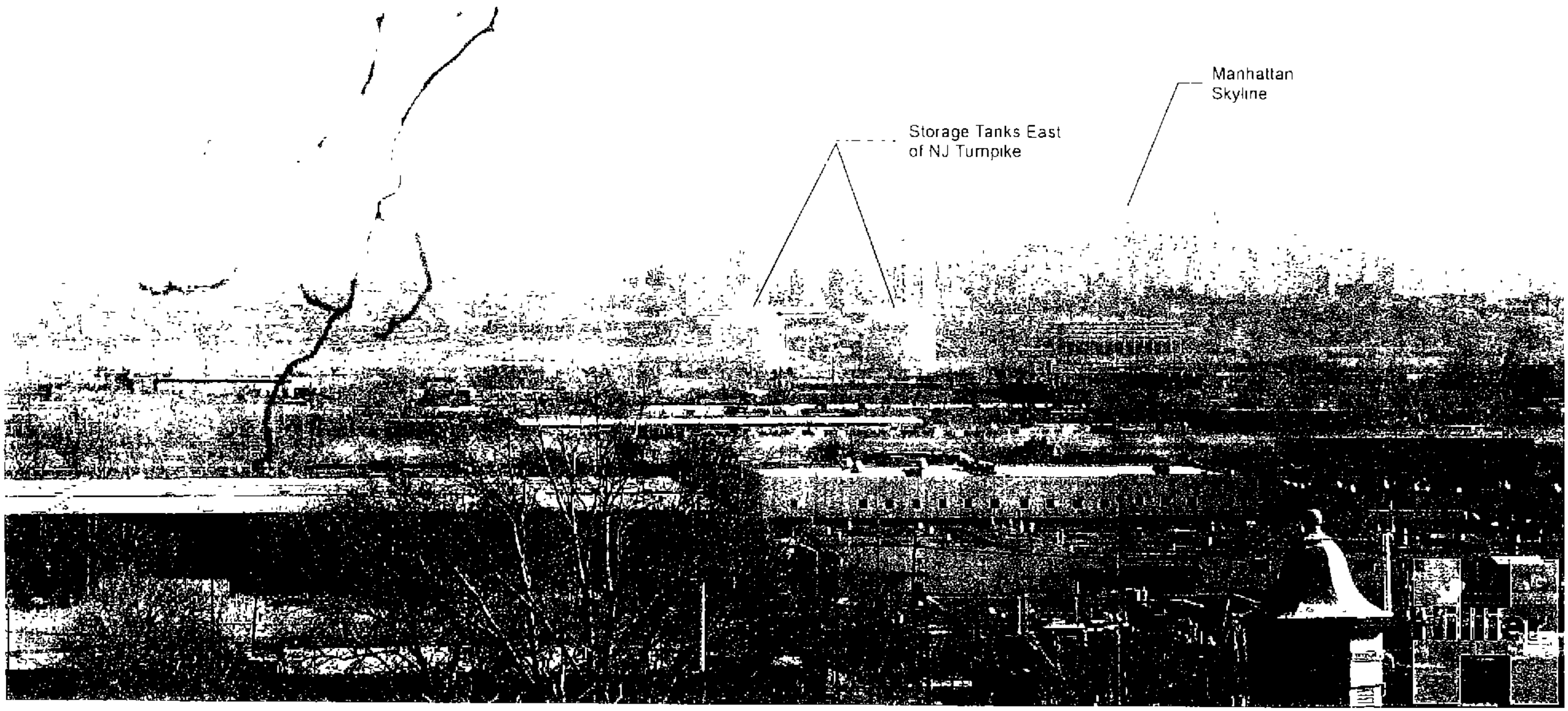


Figure I B-1

2.0 Geology and Soils

2.1 Geology

The Empire tract is located within the glaciated section of the Piedmont physiographic province of the Appalachian Highlands. The underlying bedrock is red sandstone, siltstone, and shale of the New Brunswick Formation. The Empire tract has been covered by at least three glacial advances. The ice sheets of the glaciers moved through the Hackensack River Valley, scouring and eroding the land surface and then depositing eroded material as they retreated.

During the last glacial advance, a glacial lake known as Lake Hackensack was formed as the glacier began to melt and retreat northward. A terminal moraine formed a dam across the valley between the Watchung Mountain Range and the Palisades Sill. The glacial meltwaters flowing into the lake carried soil particles which were deposited on the lake bottom as relatively thin layers of sand, silt, and clay. These layers are called "varves." The coarser soil particles, sands, and silts settled out during the warmer periods of the year. During the winter, when runoff into the lake and, correspondingly, the supply of coarse particles was less, the fine-grained, suspended clay settled out. Typically, annual deposition resulted in one coarse-grain varve and one fine-grain varve. Based upon soil borings performed on the Empire tract, to date the stratum of varved silts and clays is a maximum of about 60 ft in thickness beneath the site; however, there are areas in the meadowlands where the varved silt and clay stratum is nearly 200 ft in thickness.

At some point in time the water levels in the ocean and lakes elevated and the dam broke, eventually draining Lake Hackensack and eroding the terminal moraine. It is believed that there was some desiccation of the upper portion of the varved silt and clay stratum that resulted in it being somewhat stiffer than the deeper portion of the stratum.

Subsequent to the draining of the lake, a discontinuous layer of silty sand was deposited over portions of the valley. Then, with the rising ocean level, organic deposits occurred and tidal marsh areas developed in the Hackensack River Valley.

The bedrock in the HMD is composed mainly of reddish brown arkosic sandstone, mudstone, and shalestone of the Brunswick Formation, which is one of the Newark Group sedimentary rocks of Late Triassic age. The sediments in the rock originated predominately from rocks of the Paleozoic and Precambrian ages, and subsequently were deposited in a nonmarine basin. Most of the bedrock in the area is covered by unconsolidated glacial deposits that originated from the last Wisconsin advance of the continental ice sheets across the Hackensack River Basin.

2.2 Soils

Based on available subsurface exploration information and laboratory test data of soil samples, the stratification of the subsurface soil at the proposed area of development consists of four major categories:

- Organic silt with a peat layer;
- Varved silt and clay;
- Glacial till; and
- Decomposed bedrock from top to bottom.

Figure I.B-2, Boring Location Plan, shows a plan view of the Empire tract with the locations of subsurface testing indicated. Boring cross-sectional profiles of the site are presented in Figures I.B-3, Subsurface Profiles, and I.B-4, Subsurface Profile.

Brief descriptions of the stratum are provided as follows:

Stratum 1 - Peat (P) and Organic Silt and Clay (OS+C)

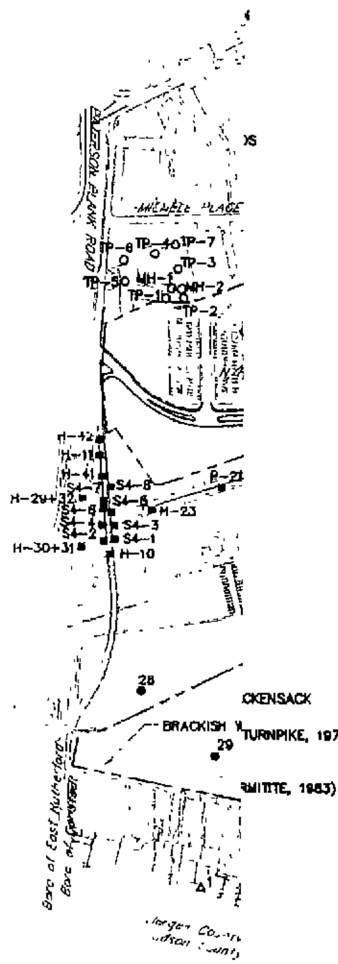
Stratum 1 is the gray black organic soil stratum and includes meadow mat, peat, and organic silt and clay. Identification depends on the amount of fibrous vegetation present with respect to soil particles. This stratum is very soft to soft in consistency, highly compressible, and has a very low shear strength. The organic soils, peat, and organic silt and clay, which are present over most of the Empire tract, typically vary from three to as much as eleven ft in thickness. Based on soil boring data, the organic silt with peat layer ranges in thickness from about seven to 15 ft in thickness in the area east of the NJ Turnpike.

Stratum 2 - Upper Varved and Varved Silt and Clay (UVSC and VSC)

The gray brown varved silt and clay stratum deposited from Glacial Lake Hackensack is present beneath most of the Empire tract. It was not encountered in a few of the explorations on the southwestern and western portions of the larger tract. The stratum varies from stiff to very soft in consistency. Generally, the upper three to five ft of this stratum is stiff in consistency, then the stratum becomes soft to very soft beyond that depth. The upper portion of the stratum went through a series of discications and formed an over-consolidated crust layer, and is designated as upper varved silt and clay.

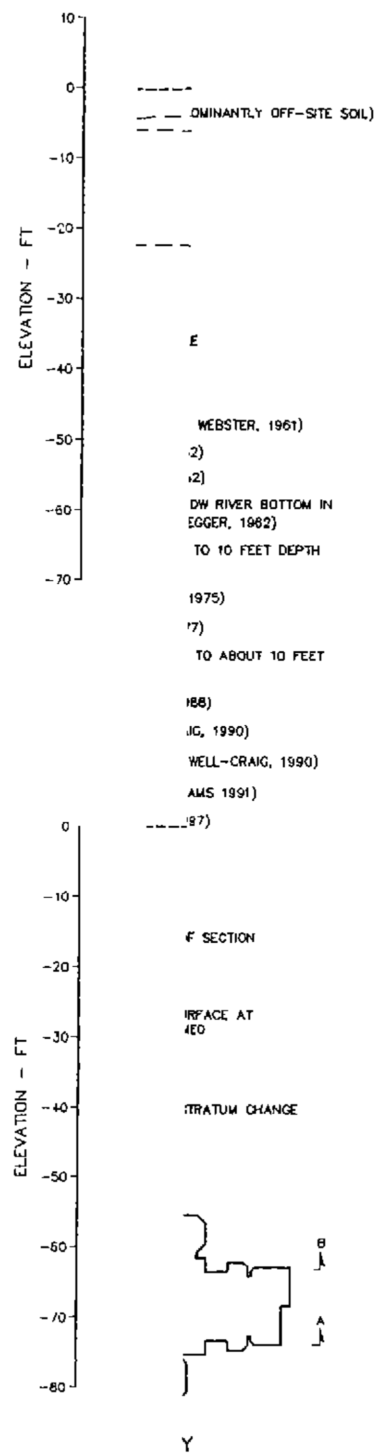
The lower portion of the varved clay layer, due to the shear strength and compressibility characteristics of the material, is one of the major contributors to the overall stability and short and long term settlement for the proposed development.

The thickness of the entire stratum varies from zero to about 35 ft. Beneath the western portion of the proposed building footprint, the stratum is typically from zero to about five ft in thickness, while beneath the eastern portion of the larger tract it varies typically from about 20 to 32 ft in thickness.



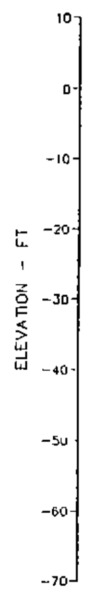
MCNEILL PLACE
TP-8
TP-4
TP-7
TP-3
TP-5
MH-1
MH-2
TP-10
TP-2
H-42
H-11
H-41
S4-8
S4-7
S4-6
H-29+32
H-23
S4-3
S4-2
S4-1
H-30+31
H-10
28
CKENSACK
BRACKISH
TURNPIKE, 1972)
29
RMITTTE, 1983)
Boro of East Rutherford

Figure I.B-2



ELEVATION - FT
10
0
-10
-20
-30
-40
-50
-60
-70
OMINANTLY OFF-SITE SOIL)
E
WEBSTER, 1961)
:2)
i2)
DW RIVER BOTTOM IN
EGGER, 1962)
TO 10 FEET DEPTH
1975)
'7)
TO ABOUT 10 FEET
)88)
IG, 1990)
WELL-CRAIG, 1990)
AMS 1991)
)87)
ELEVATION - FT
0
-10
-20
-30
-40
-50
-60
-70
-80
F SECTION
IRFACE AT
IED
TRATUM CHANGE
B
A
Y

Figure I.B-3



LEGEND:

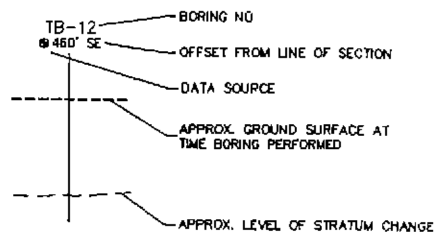
STRATIGRAPHY

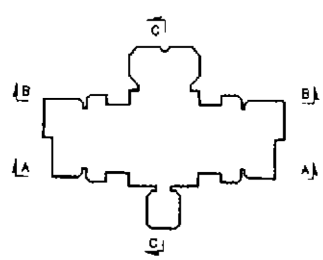
F	FILL (SOURCE OF MATERIAL PREDOMINANTLY OFF-SITE SOIL)
P	PEAT
OS+C	ORGANIC SILT AND CLAY
S+S	SAND AND SILT
UVSC	UPPER VARVED SILT AND CLAY
VSC	VARVED SILT AND CLAY
GT	GLACIAL TILL
DS	DECOMPOSED SHALE
SSS	SANDSTONE, SILTSTONE, OR SHALE

DATA SOURCES

- BORING TO REFUSAL (STONE AND WEBSTER, 1961)
- PROBE TO REFUSAL (EMPIRE, 1962)
- BORING TO 25 FEET (EMPIRE, 1962)
- BORING TO 25 TO 32.5 FEET BELOW RIVER BOTTOM IN HACKENSACK RIVER (KENNEDY RIEGGER, 1962)
- BORING TO DENSE TILL/ROCK OR TO 10 FEET DEPTH (NJ TURNPIKE, 1972)
- BORING TO ROCK (NJ TURNPIKE, 1975)
- BORING TO REFUSAL (RUSSO, 1977)
- BORING TO 22 FEET OR TEST PIT TO ABOUT 10 FEET (HERMITITE, 1983)
- BORING TO ROCK (JOB & JOB, 1988)
- BORING TO ROCK (TESTWELL-CRAIG, 1990)
- BORING TO 27 TO 29 FEET (TESTWELL-CRAIG, 1990)
- BORING TO ROCK OR REFUSAL (TAMS 1991)
- TEST BORING LOCATION (TAMS 1987)

BORING





KEY

Figure I.B-4

Stratum 3 - Glacial Till (GT)

The glacial till stratum is continuous beneath the Empire tract. It is comprised of varying amounts of red brown sand, gravel, silt, and clay, and often contains boulders and cobbles. The material is typically dense to very dense. The thickness of the glacial till stratum varies from less than ten feet to more than 30 ft.

Stratum 4 - Decomposed Shale and Bedrock (DS and SSS)

The bedrock underlying the Empire tract is red brown sandstone, siltstone, and/ or shale. This bedrock is typical weathered and highly fractured at the surface and becomes sounder at depth. The top of the bedrock is approximately 20 ft below ground surface at the western end of the Empire tract and approximately 70 ft below ground surface at the eastern portion of the proposed building footprint

Other Units

In addition to the four main stratum of subsurface soil materials found on the Empire tract, there are other specific geologic classification units, including off-site fill materials, silt, sand, and gravel, that occur in small quantities across the site and are not at all continuous.

Off-site fill is found in small isolated areas. The fill material is comprised predominantly of soil from off-site sources, and is of apparent variable composition and density.

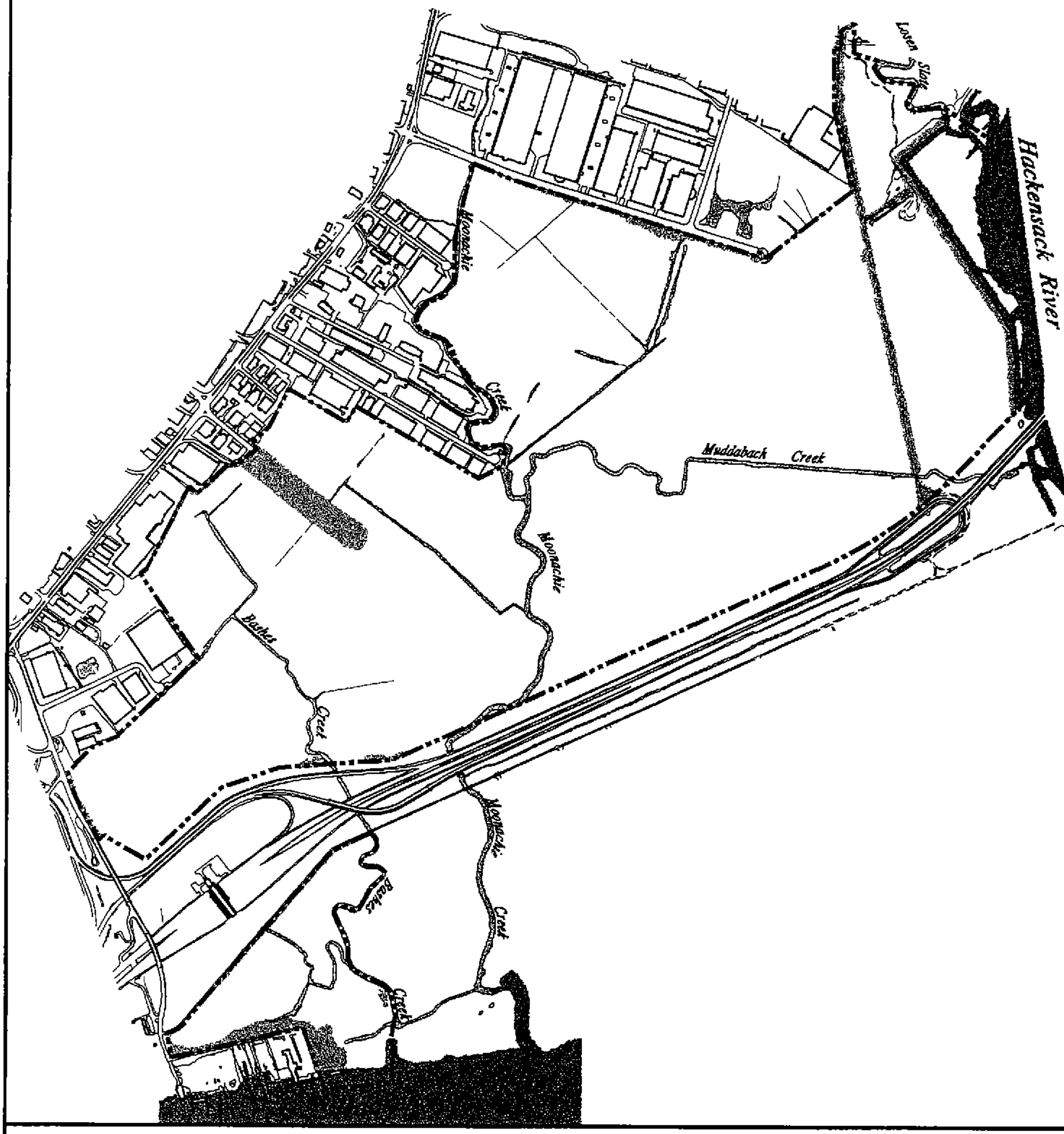
There are some sand, gravel, and silt layers that occur in small quantities throughout the Empire tract in non-continuous layers and, when present, are typically three ft or less in thickness. The brown sand and silt stratum was encountered in several locations along the western portion of the larger tract beneath the organic soils. The sand and silt layers vary from very loose to medium dense. This stratum contains varying amounts of silt and, at some locations, the silt is more predominant than the sand fraction of the stratum.

3.0 Drainage

3.1 Existing Drainage Patterns

The Empire tract, as shown in Figure I.B-5, Existing Conditions, drains generally from west to east and/or north to south to the Hackensack River via four main waterways: Losen Slote, Moonachie Creek, Muddabach Creek, and Bashes Creek. The width of the creeks varies from 40 ft at the widest point of Moonachie Creek, to just a few feet for the smallest irrigation and mosquito control ditches draining throughout the Empire tract. All of the creeks and ditches are relatively shallow with depths of less than two ft.

Existing Conditions



Uplands
Non-Tidal Water
Tidal Water
Tide Gate
Property Boundary

1200 0 1200
Scale in Feet
400 0 400
Scale in Meters

N

Figure I.B-5

All of the on-site creeks discharge to the Hackensack River through tide gates currently situated at the mouths of Moonachie Creek, Muddabach Creek, and Losen Slote. Bashes Creek is separated from the Hackensack River by a levee, and is currently diverted through a channel to Moonachie Creek and its tide gate. The tide gates prevent river water intrusion during rising tides, and allow upstream surface water flows to be discharged when the Hackensack River is at or near low tide. The berms and tide gates prevent daily tidal inundation and, to some extent, limit the inundation of the upstream areas from tidal storm surges.

During rainfall events, adjacent industrial areas to the north and west of the Empire tract contribute runoff via both storm sewer discharges and overland flow. The site receives these waters, stores them, and provides attenuation prior to discharging the flows to the Hackensack River through the tide gates. Water is detained within the creek channels until the hydrostatic head induced by detained storm water overcomes the sum of the hydrostatic head of the Hackensack River and minor energy and friction losses at the tide gates and culverts. When the hydrostatic head in the creek channels is greater than the hydrostatic head in the river, the tide gates open and the storm water detained in the channels is discharged.

The tide gate structure at Moonachie Creek consists of a 36-inch diameter corrugated metal pipe (CMP) and a 30-inch diameter cast iron pipe (CIP). Standard flap gates exist on the downstream end of these pipes. Muddabach Creek has one tide gate installed on a 30-inch diameter CIP. The tide gates at these locations have occasionally leaked, allowing some brackish water from the Hackensack River to enter interior ditches on the Empire tract. Maintenance activities have been conducted by the Bergen County Mosquito Commission to fix the leaking tide gates and raise low areas of the berms, including a replacement tide gate that was installed at the mouth of Losen Slote in 1991.

A 20-ft wide reinforced concrete box culvert located at Moonachie Creek and two 10- and 11.5-ft-wide reinforced concrete box culverts at Bashes Creek allow water to pass under the NJ Turnpike Western Spur and to the Hackensack River. The Transco inspection road crosses both Moonachie and Bashes Creeks to the east, immediately downstream of the turnpike culverts. Moonachie Creek flows freely under the Transco access road bridge; however, the flow of Bashes Creek is partially restricted at the Transco access road embankment.

Levees or berms exist along the right bank of the Hackensack River, at the edges of the Empire tract, preventing tidal flood waters of lower return periods from entering the site. Other structures that alter drainage patterns on site include the NJ Turnpike embankment and a series of access roadways and pipeline corridors constructed by Transco to maintain their natural gas pipeline systems. As a consequence of these various features, the property is hydraulically isolated from the Hackensack River. Therefore, conditions on the property are significantly drier than would be expected at a meadowlands location with similar surface elevations.

3.2 Flooding on the Empire Tract

As illustrated in Figure I.B-6, 100-Year Floodplain in the Hackensack Meadowlands District, the entire site will be inundated during a 100 year flood (Zone AE) (a flood with a one percent chance of being equaled or exceeded during any particular year) as defined by the Flood Insurance Study (FIS) developed by the Federal Emergency Management Agency (FEMA). The Flood Insurance Study and the final Flood Insurance Rate Maps (FIRM) for the HMD were released by FEMA in September 1995. It should be noted that the water surface elevations as reported in the FIS by FEMA were calculated using LATIS, a hydrodynamic program which is currently being used for the hydraulic design of the brackish marsh for the Meadowlands Mills project. The nodes illustrated in Table I.B-1 are from LATIS modeling for the FIS. Details of the LATIS model can be found in Hydraulic/Hydrologic Analysis for Brackish Wetland Mitigation and Flood Control (TAMS, 1998).

Table I.B-1

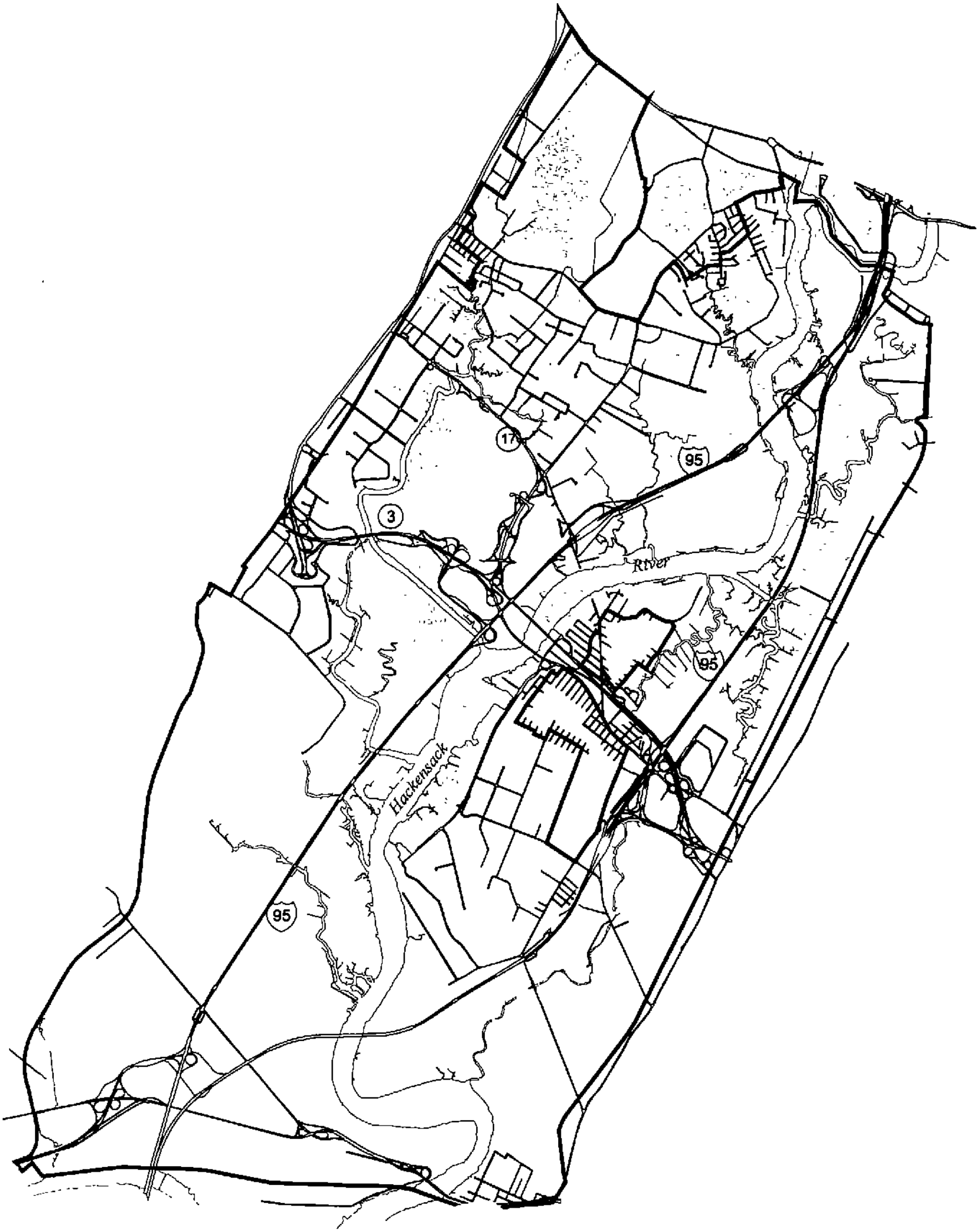
Flood Elevations for Different Frequencies

Location	Water Surface Elevation (feet, NGVD)			
	10-year	50-year	100-year	500-year
Node 76 - Losen Slote Upstream of Empire tract	6.6	8.0	8.7	9.1
Node 17 - Hackensack River Adjacent to Empire tract	6.6	8.0	8.6	9.1
Notes: Flood elevations are approximately the same at the Hackensack River node as they are 5,000 ft upstream on Losen Slote. Source: FEMA, 1995				

According to the FIS analysis, the 100-year flood has a water surface elevation of 8.6 ft NGVD for the main stem of the Hackensack River east of the NJ Turnpike and 7.5 ft NGVD for the Empire tract interior west of the NJ Turnpike. Table I.B-1 lists the water surface elevations of the FIS at stations in Losen Slote and in the Hackensack River adjacent to the Empire tract (FEMA, 1995). These elevations are called stillwater elevations as they neglect the effect of waves. As shown on the FIRM, the 100-year base flood elevation is nine ft NGVD at the river near the Empire tract and inland up to the NJ Turnpike, and eight ft NGVD farther inland in the central portion of the site at the location of the proposed development.

It has been established by FEMA as well as other federal agencies such as the USACE that flooding at the site as well as areas upstream of the site is a result of coastal storms, or tidal surges. Therefore, it is important to note that 100-year flood elevations as tabulated in the above table as well as listed in the FIS are determined by the increased tidal flow through the Hackensack River from Newark Bay, and are not based upon river flow resulting from rainfall.

100-Year Floodplain in the Hackensack Meadowlands District



FEMA Mapped 100-Year Flood Zone
HMDC Boundary
River Channel
Road

3000 0 3000 6000 Feet

N

Figure I.B-6

During the northeaster of December 1992, a tidal surge from the Hackensack River overtopped the banks of the Hackensack River upstream of Losen Slote and flooded the low-lying meadow areas contiguous with the meandering reaches of Losen Slote upstream of the Losen Slote pumping station. The frequency of this storm event was between 25 and 30 years, as reported by the New York District USACE, and independently verified by TAMS. The flood elevation in the Hackensack River near the Empire tract during the December 1992 coastal storm was approximately 7.3 ft NGVD. During this storm, flooding was observed on portions of the Empire tract as well as some of the industrial/commercial areas immediately west of the Empire tract where elevations are less than six ft NGVD.

3.3 Surface Water Hydrology

The FIS was also utilized to approximate the amount of fluvial flow (riverine, non-tidal freshwater flow) in the Hackensack River adjacent to the subject property. The following discussion of existing peak flow rates in the Hackensack River and the Empire tract drainage areas is presented to illustrate how small the Empire tract drainage area is when compared to the Hackensack River drainage area. The Hackensack River stations near Losen Slote include (FEMA, 1995):

- Confluence with Overpeck Creek
  Hackensack River Drainage Area = 134.4 square miles (sq mi)
  Location - 8,600 ft north of Losen Slote
  100 - Year Flow - 7,519 cfs

- Confluence with Bellman's Creek
  Hackensack River Drainage Area = 154.4 sq mi
  Location - 5,800 ft south of Losen Slote
  100 - Year Flow - 10,710 cfs

Therefore, the flow at the Hackensack River/ Losen Slote confluence as estimated by straight-line interpolation (FEMA, 1995) is 9,421 cfs.

For existing conditions in the Empire tract drainage area, the 100-year peak fluvial flow rate has been calculated to be approximately 130 cfs. This was calculated by summing the attenuated discharges at the Moonachie Creek and Muddabach Creek tide gates, utilizing XP-SWMM dynamic hydraulic modeling software. This peak flow is approximately 1.4 percent of the estimated 100-year Hackensack River flow near Losen Slote.

3.4 Groundwater Hydrology

Based on data collected by TAMS in 1991 and 1996, it has been determined that the groundwater across the Empire tract is typically one to two feet below the ground surface or between approximately elevation 0 to elevation -1 ft NGVD. This shallow groundwater surface is contained within the upper peat/organic layer which for the majority of the site overlays a much less permeable

varved silt and clay layer. The level of the groundwater varies with rainfall, tides, and climatic factors.

The shallow groundwater at the site is not a potable water source and the effect of rainfall on its level is heavily influenced by the bedrock ridge at Washington Avenue along the west side of the site, which is likely to serve as a shallow groundwater divide.

At the Meadowlands Mills site the groundwater elevations may also vary with the tide. Tidal influence, however, is dependent on several factors including the tidal amplitude, the radian frequency of the tide, soil permeability, and soil porosity. The variation will also depend on any recharge from precipitation events (Figure I.B-7, Tidal Influence on Groundwater).

A mathematical model was developed by TAMS for the site to determine the tidal influence on the groundwater hydrology. This model incorporated measured and field-tested soil properties such as soil permeability and porosity.

For a tidal range of 6.6 ft (2.0 m), the mean spring range in the Hackensack River, the variation in groundwater elevations at different distances from the river bank is illustrated in Figure I.B-6. This graph shows that the tidal influence on groundwater elevations decreases with distance from the river. For the Empire tract, at distances 50 ft (15 m) from the river bank there is no tidal influence on the groundwater.

4.0 <u>Zoning</u>

Under the zoning jurisdiction of the HMDC, the Empire tract is zoned as shown in Figure I.B-8, Zoning and Tract Plan. Planned Development Center-1 (PDC-1) zoning applies to Tracts 1 and 2, which encompass most of the site. Tract 4 is zoned Light Industrial A. Tract 3 is zoned Light Industrial B. Park and Recreation zoning applies to Tract 6.

The Empire tract is one of a number of Specially Planned Areas and thus is zoned PDC-1, as defined in the HMDC zoning ordinance. The designation of Specially Planned Area is reserved for large parcels in strategic locations. The HMDC recognizes that innovative design opportunities exist for such parcels, and that the benefits of such design and resulting development would have great value for the public and for the region as a whole.

Light industrial zones in Tracts 3 and 4 allow application of the zoning regulation governing Planned Unit Development (PUD). The purpose of a PUD is to encourage the innovative and creative design of developments of varying sizes and to facilitate the use of the most advantageous construction techniques. Application of the PUD option facilitates achievement of HMDC Master Plan goals and PDC-1 zoning in the context of a unified development.

Tidal Influence on Groundwater

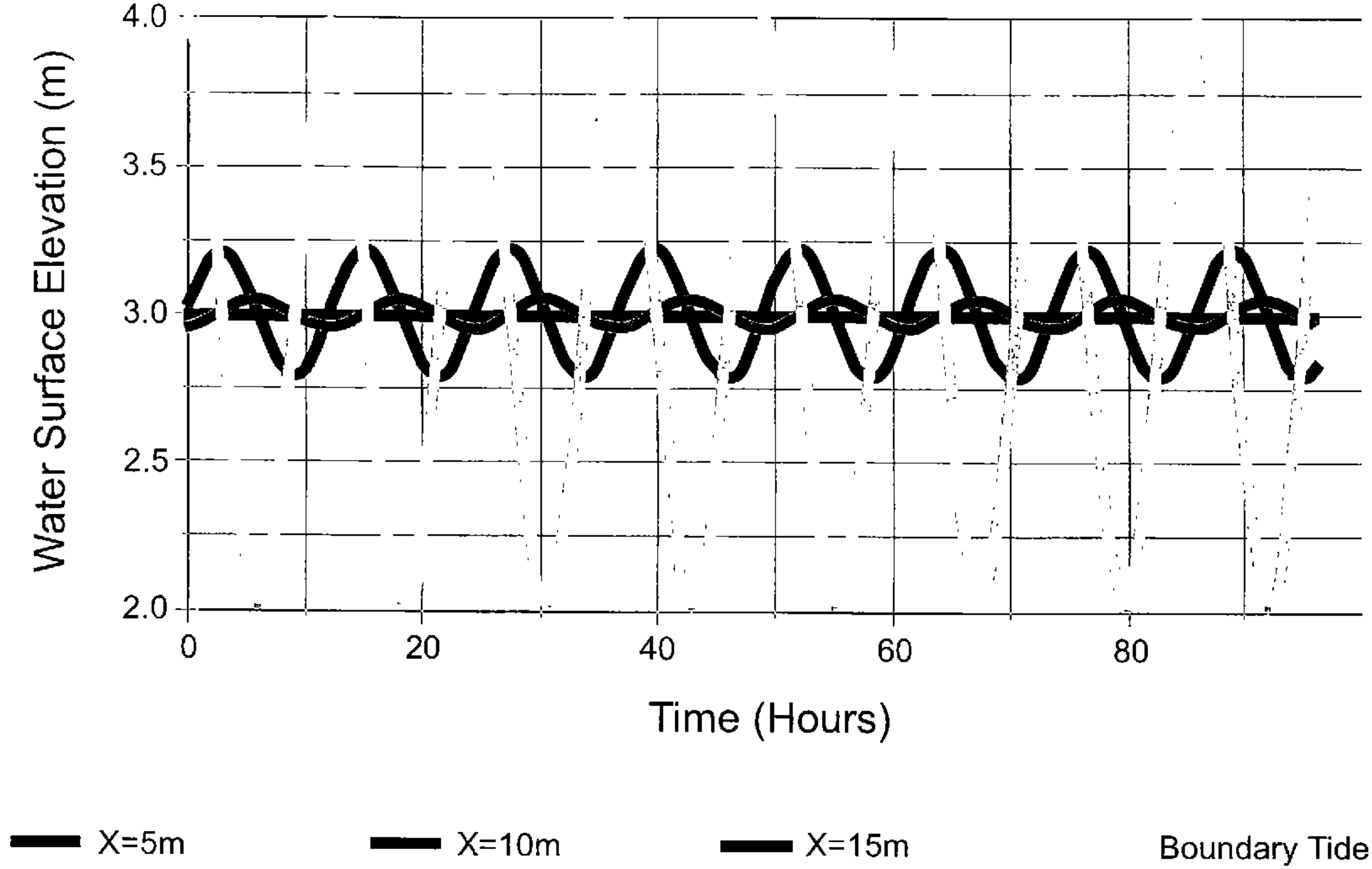
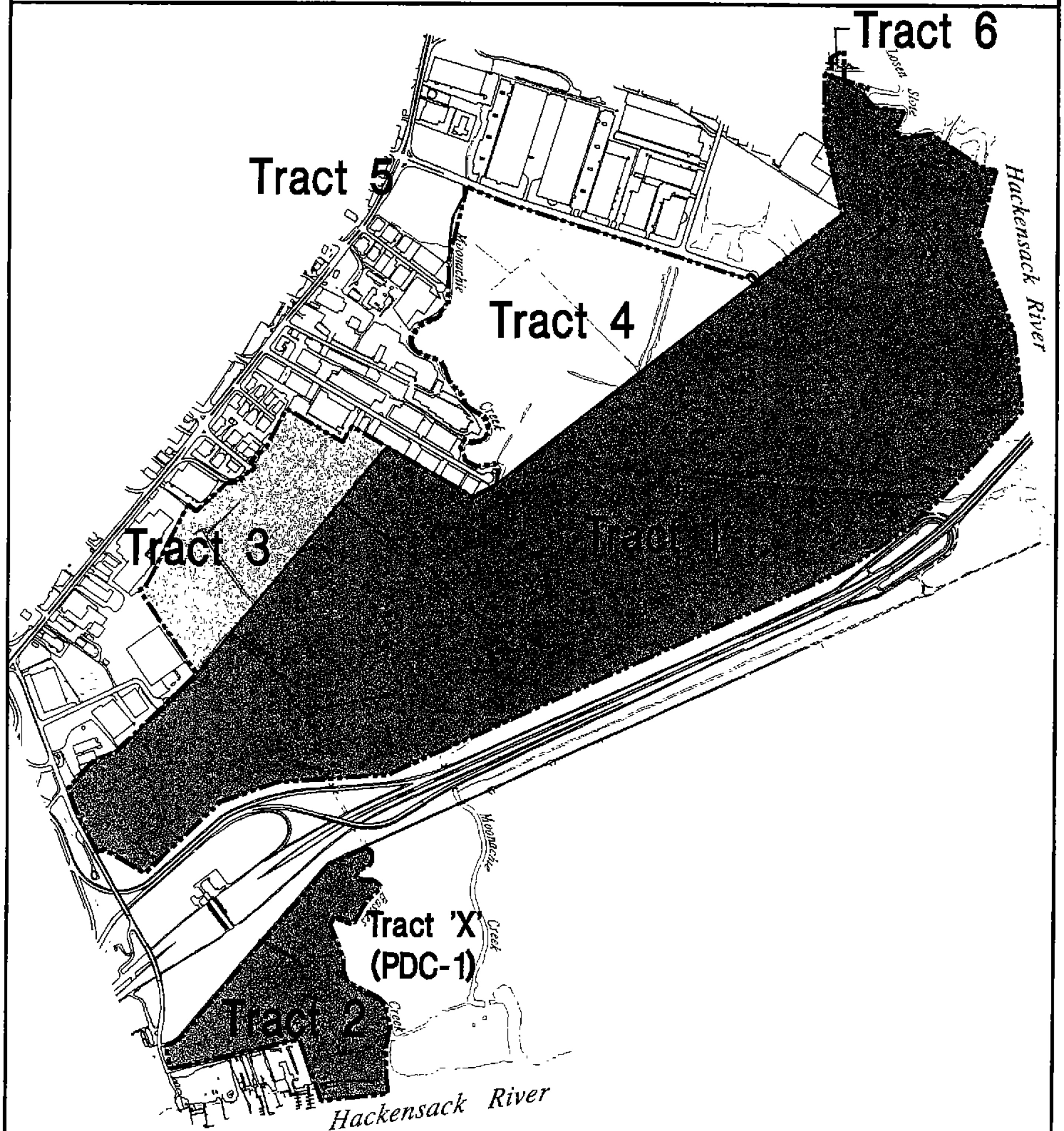


Figure I.B-7

Zoning and Tract Plan



Planned Development Center / PDC-1

Lt. Industrial 'A' (PUD Optional)

Lt. Industrial 'B' (PUD Optional)

Park and Recreation

Property Boundary

1200 0 1200

Scale in Feet

400 0 400

Scale in Meters

N

Figure I.B-8

Park and Recreation zoning requires that all uses in this zone be operated and maintained in a manner consistent with a desirable environment and a park and recreation atmosphere. Under the Meadowlands Mills development, Tract 6 would be preserved in its existing condition.

In order to monitor the development and design processes, HMDC has formulated specific procedures for all Specially Planned Areas, including the PDC-1 zone applicable to the Empire tract. The approval process requires three application stages, all of which involve in-depth review by HMDC in accordance with state law. The application stages consist of the following:

- General Plan: The General Plan submission provides details on existing Empire tract conditions and the proposed uses, and requires schematic data, including an assessment of the environmental impacts of the proposed project. The General Plan for the project was approved by HMDC in April 1993.

- Development Plan: The Development Plan submission pertains either to a portion of the development (e.g. initial phase) or to the entire project. Specific descriptions of height and bulk of buildings, open space location and use, preliminary landscaping plans, provisions for parking, streets, and utilities, and data on community facilities and the like are required, as are detailed site engineering data and an assessment of environmental impacts.

- Implementation Plan: This submission is filed for sections or subsections of the Specially Planned Area for which a Development Plan (or Plans) has (have) been approved. Exact building dimensions, locations, and services are recorded. All utilities and construction both on the Empire tract and in affected water courses are shown in detail. All environmental performance standards must be described and a detailed environmental impact assessment is required.

C. VEGETATION

1.0 General Characteristics

The HMD is located in the northeastern portion of New Jersey, in a valley between the Watchung Mountains and the Palisades, in the southern portion of the physiographic region known as the New Jersey Piedmont. The 200-sq mi Hackensack River Basin was formed during glaciation by ice scouring, and then was filled by glacial and marine deposits. The lowlands were flooded by rising sea levels as the glaciers melted, forming an estuary with large wetland areas. This estuary was tidal, as the Hackensack River is linked to Newark Bay and the Atlantic Ocean.

The Hackensack River has its source in the northern part of the Palisades Ridge in Rockland county, New York. The Hackensack River flows generally south for 50 mi, parallel to and a few miles west of the Hudson River. Water levels below New Milford, New Jersey are controlled by a semi-diurnal tide, reaching from the Hackensack River's mouth at Newark Bay north to New Milford, a distance of more than twenty mi.

When the Hackensack Water Company constructed Oradell Dam, built above the head of the tide and upstream from New Milford, to create Oradell Reservoir during the 1920s, the freshwater portion of the Hackensack River was artificially separated from the lower estuary. The presence of the dam controls a portion of the freshwater flow into the remainder of the Hackensack River. Freshwater in the Hackensack River below the dam is derived from three sources: precipitation and runoff (50 percent); sewage discharge (30 percent); and releases from Oradell Reservoir (20 percent) (TAMS, 1991). During summer, lower flows pass over the dam than during other parts of the year and, at times, there is no flow over the dam into the lower Hackensack River (JMA, 1978). As a result of damming, freshwater flushing of the estuary does not occur to the extent it would in a typical estuary.

The HMD as a whole has been described frequently as a highly disturbed ecosystem. Poor water and sediment quality, attributed to the discharge of industrial and residential wastewaters into the Hackensack River over a period of many decades, exists throughout the area (University of Pennsylvania, 1969; JMA 1978; Ludwid, 1988).

According to the SAMP DEIS (USEPA and USACE, 1995), the HMD wetlands have undergone a great deal of transition since the last glacier retreated from New Jersey approximately 17,000 years ago:

> "The melting water [of the glaciers] became trapped behind the moraine to form Glacial Lake Hackensack. Based on analyses of the sediment deposited during this time, the glacial lake existed for at least a period of 2,000 to 3,000 years. Based on recent evidence, the local environment of the Meadowlands after the moraine was breached and the glacial lake drained (approximately 14,000 years ago) was most likely a well-drained woodland of alder and oak. Wetland environments were probably first formed in the Meadowlands between 2,000 and 3,000 years before the present (BP). As the climate continued to warm, and the glaciers

continued to melt, the sea level began to rise. Currently accepted rates of sea level rise for this area are between 1.0 and 1.5 meters (m) per 1,000 years. Thus, between 2,000 and 3,000 years ago, the water elevation in Newark Bay and any tidal reaches of the Hackensack River would have been between 2.0 and 4.5 m (6.5 to 15.0 feet [ft]) lower than today. Approximately 2,000 BP, with the rising sea level, many parts of the Meadowlands began to evolve, first into freshwater wetlands, and then into tidal wetlands, vegetated predominantly by salt grass.

"About 800 BP, the first Atlantic white cedar (*Chamaecyparis thyoides*) trees appeared in the Meadowlands. The cedar bogs predominated for some three to five centuries, and began to dwindle, beginning about 500 years ago. According to late 19th century maps, the then surviving cedar stands were limited to only a few scattered areas, surrounded by common reed (*Phragmites australis*). The apparent island pattern of isolated survival is consistent with ecological models of the takeover of one plant community by another. The pattern of survival also suggests that the former extent of cedar bogs in the Meadowlands was much larger than was found in the late 19th century.

"Recent changes in the Meadowlands have been more abrupt, and more drastic. The first cause of change was the attempt to "reclaim" the Meadowlands as arable land, and beginning in the 1930s, to control mosquito breeding. The diking and ditching undertaken to drain the Meadowlands probably aided in the decline of the cedar bogs. In 1867, the Iron Dike Land Reconstruction Company constructed a dike along the northern bank of the lower Passaic River, around Kearney Point, along the western bank of the Hackensack River, and finally up Sawmill Creek. The section of land that this dike isolated contained a large cedar swamp, which was shown as a "former" cedar swamp on an 1896 map. Because diking prevents the influx of tidal water, and also dried out the marsh, this dike probably contributed to the loss of cedar in the Sawmill Creek area. (However, as stated above, evidence suggests that the cedar swamps started declining approximately 500 years ago, thus some of the reasons for the decline are probably "natural.") Further human factors in the decline of the cedar in the Meadowlands may have been harvesting for use in ship building, to make plank roads to traverse the Meadowlands, and for lumber and shingles; some of the cedar swamps were also burned to drive out pirates.

"The second major cause of change in the Meadowlands environment was the construction of the Oradell Dam (completed in 1922). This dam limited fresh water inputs into the Hackensack, and increased the tidal effects, moving the head of tide upstream. As the population served from the Oradell Reservoir increased, passing fresh water flows decreased, resulting in a more saline environment for most of the District.

"A final major historic event also relates to both the dikes that were built to "reclaim" the wetlands and the construction of the Oradell Dam. Because the dikes isolated large expanses of land from tidal waters, the layers of peat that existed at the bottom of the marshes began to dry out, and subside. Common reed (*Phragmites australis*) began to colonize these drier,

less saline areas. A subsidence of three to three and a half ft was reported in the Meadowlands in just 18 years (from 1869 to 1887). Thus, the land behind the dikes sank to lower elevations than the water level in the Hackensack River. In 1950, a major hurricane breached most of the dikes, and the saline waters of the Hackensack River (due to the Oradell Dam) flooded large expanses of the Meadowlands. In some areas (e g., the Sawmill Creek Wildlife Management Area) the *Phragmites* were unable to survive in the deeper, more saline water, and large expanses died off. The resulting mudflats were only recently being slowly re-vegetated by salt-marsh cordgrass (*Spartina alterniflora*).

"The current major water circulation patterns in the estuary were established in 1922 with the construction of the Oradell Dam. The dam limited the flow of freshwater to the downstream portions of the Hackensack River, and thus, increased the upstream encroachment of salt water.

"In addition to draining the marshes, some of the estuary was filled to provide land for residential and industrial development. As a result, a total of approximately 8,500 acres of the original wetlands and aquatic habitats in the lower Hackensack River Basin remain in the District today."

The range of habitats in the HMD are diverse, although few of the habitats that occur in the HMD are found on the Empire tract. The following seven natural habitats occur in the HMD. Habitat descriptions are summarized from the DEIS for the SAMP (USEPA and USACE, 1995):

- Bay and mudflats - Shallow tidal bays and mudflats of the lower Hackensack River tend to occur mostly in the Sawmill Creek Wildlife Management Area. These habitats are closest to the river's mouth, and have higher salinities than any other habitats in the HMD. The large expanse of mudflats is of recent origin, forming after the 1950 hurricane. Three types of biota typically utilize mudflat habitat in the HMD: invertebrates that live in the mud, birds and fish that feed on the mudflat invertebrates, and waterfowl that use mudflats for refuge areas.

- Low salt marsh - These areas are dominated by salt marsh cordgrass (*Spartina alterniflora*), and are typified by salinities between 10-15 parts per thousand (ppt). The largest area of low salt marsh occurs along the banks of Sawmill Creek. Other areas include portions of Anderson Creek, Lower Berrys Creek, and along the edge of the Hackensack River, in locations such as the HMDC Harmon Meadow Wetlands Mitigation Area. Biota that occur in this habitat include mud snails, crabs, and a variety of rails and bitterns.

- High salt marsh - High salt marshes are dominated by salt hay grass (*Spartina patens*) and salt grass (*Distichlis spicata*) and occur adjacent to areas where low salt marshes are found. High salt marshes also contain species tolerant to elevated salinities, such as glassworts (*Salicornia* spp.), some insects, and mummichogs (*Fundulus*

heteroclitus). In addition to the same animal species as found in the low salt marsh, high salt marshes provide habitat for mice and voles.

- Common reed - Approximately 62 percent (5,200 acres) of the HMD wetland and aquatic habitat is common reed (*Phragmites australis*) habitat. *Phragmites* dominates wetlands in the northern HMD, and has overgrown all stands of narrow-leaf cattails (*Typha angustifolia*). According to the SAMP DEIS (USEPA and USACE, 1995), muskrats (*Ondatra zibethicus*) use *Phragmites* plants both for food and as construction materials for their lodges, and Least Bitterns (*Ixobrychus exilis*) nest in the *Phragmites*.

- Freshwater marsh - Freshwater marshes in the HMD are wetlands that are not connected to tidal waters, and which are influenced by freshwater from upland runoff or groundwater. Freshwater marshes of various sizes are found in Kearney Marsh, the Penhorn Creek basin, North Bergen, Losen Slote Creek, areas near Teterboro, and in small pockets throughout the lower Hackensack River floodplain. Although freshwater marshes in the HMD often contain grasses, such as *Panicum* and *Andropogon*, most HMD freshwater marshes are dominated by *Phragmites australis*.

  In addition, naturally wooded areas occur in freshwater marsh areas such as those near Teterboro Airport, Losen Slote Creek, and around Snake Hill. Several species of animals are unique to HMD freshwater marshes, such as herpetofauna including snapping turtle (*Chelydra serpintina*), spotted turtle (*Clemmys guttata*), Eastern painted turtle (*Chrysemys picta*), and the Southern leopard frog (*Rana sphenocephala*). In addition, breeding birds include Red-winged Blackbirds (*Agelaius phoeniceus*), Marsh Wrens (*Cistothorus palustris*), and Green Herons (*Butorides striatus*)

- Brackish impoundment - The diking and ditching that occurred in the HMD to create the freshwater marshes also created brackish impoundments: areas where dikes have been breached or leak, thus allowing an inflow of salt water. The brackish impoundments are important habitats for birds, such as wading birds and shorebirds, due to the high ecological aquatic productivity.

- Open water - The SAMP considers the open waters of the Hackensack River and its tributaries as separate habitats from those found in shallower wetlands. As these areas do not dry out, many species of fish survive in the open waters of the Hackensack. According to the DEIS for the SAMP (USEPA and USACE, 1995), "the aquatic regions of the District are tightly linked with the wetlands in the coastal ecosystem by providing the mechanism for transporting water (and thus nutrients, organic matter, toxics, and [wildlife] species) into and/or out of the wetlands."

Recent HMDC inventories estimate that 8,500 acres of wetlands and aquatic habitats are located in the HMD (HMDC, 1992; Figure I.A-2). Of this total, approximately 5,200 acres (62 percent) are dominated by common reed (*Phragmites australis*) vegetation, while only 750 acres (9 percent) are non-*Phragmites*-vegetated wetland (HMDC, 1992). The remaining acreage (2,505 acres or 29 percent) is comprised of mudflats and open water areas.

Migratory birds along the Atlantic Flyway utilize the HMD as nesting habitat, wintering habitat, and a place to 'stop-over' to obtain resouces during migration. The Atlantic Flyway (one of four flyways in North America) is a geographically broad route along which birds travel in the spring and the fall during migration. The Atlantic Flyway stretches from Florida to Canada, and in the northeast United States includes the entire state of New Jersey and portions of Pennsylvania and New York.

Within the Atlantic Flyway, there are specific migration corridors that are used by migratory waterfowl and shorebirds, and often correspond with the regional distribution of wetland areas. As can be seen in Figure I.A-1, there are numerous wetlands and aquatic habitats in northern New Jersey where migratory waterfowl and shorebirds might occur. For example, the Great Swamp, Raritan Bay, Sandy Hook, and the HMD all provide aquatic resources for migratory waterfowl and shorebirds. Habitats that are prefered by migratory shorebirds and waterfowl include, but are not limited to, shallow water, open water, mudflats, emergent vegetation, and intertidal areas. While certain areas in the HMD provide suitable habitat for migratory waterfowl and shorebirds, such as the Sawmill Creek Wildlife Refuge, the Empire tract does not provide significant habitat for these species.

According to the HMDC "*Wetland Bio-zones*" report of June 1984, the Empire tract is considered "Zone 4," which includes *Phragmites*, cattail, and/or cordgrass. A very small portion of the site (less than 12 acres) is considered "Zone 7," open water. Although there is a narrow intermittent fringe of cordgrass or spikerush at the edge of the Hackensack River (less than three acres and less than one percent of the site area), the site is dominated almost exclusively by *Phragmites*.

2.0 Site Evaluation

2.1 Sources of Information

Data describing the existing conditions of the Empire tract have been collected and studied for many years. In 1984, a detailed study was conducted by Environmental Resources Management, Inc. (ERM) and Greiner Engineering Sciences, Inc. (GES) which examined vegetation, wildlife, water quality, air quality, noise, and aspects of the human environment (ERM and GES, 1985).

Additional studies were conducted by TAMS Consultants, Inc. (TAMS) and GES in 1991, including a re-evaluation of vegetation and wildlife, sampling of water quality, air quality, traffic and noise, and a separate investigation of land use, demographics, and public services. In 1996 and 1997, field studies were conducted by TAMS to provide updated information on natural resources, including

vegetation and wildlife. TAMS also conducted supplemental studies on hydrology, water quality, land use, demographics, and air quality, traffic, and noise, reported in this document.

Further information pertaining to the Meadowlands Mills project, and the HMD in general, is documented in a number of reports and published documents, including the following:

- *Water Quality, Wildlife and Vegetation Assessment for the Empire Tract Hackensack Meadowlands, New Jersey.* February 1985. Environmental Resources Management, Inc. (ERM) and Greiner Engineering Sciences, Inc. (GES).

- *The New Jersey Turnpike 1985-1990 Widening Technical Study Volume II: Biological Resources Interchange 8A to Interchange 9 and Interchange 11 to US Route 46.* February, 1986. NJ Turnpike Authority.

- *Species List of Organisms Found in the Hackensack Meadowlands: Vascular Plants - Mammals.* May 1987. Hackensack Meadowlands Development Commission (HMDC).

- *United States Army Corps of Engineers Wetland Evaluation and Mitigation Report for Proposed Baseball Stadium.* July 1987. Malcolm Pirnie, Inc.; TAMS Consultants, Inc.; and Yurasek Associates.

- *The Hackensack Meadowlands Development Commission Water Quality Testing Program, Eleven Year Summary: 1978-1988.* 1988. Hackensack Meadowlands Development Commission (HMDC).

- *Functional Assessment of Wetlands in New Jersey's Hackensack Meadowlands.* 1989. Maguire Group, Inc.

- *Comprehensive Baseline Studies IR-2 Site and Off-Site Mitigation Areas: Evaluation of Harmon Meadow Western Brackish Marsh Area.* January, 1990. Prepared for Hartz Mountain Industries, Inc. by TAMS Consultants, Inc.

2.2 Vegetation

Approximately 90 percent of the Empire tract is wetlands dominated by *Phragmites australis*, while approximately four percent is small upland habitats scattered throughout the site, and five percent is non-contiguous shallow water consisting of small creeks, drainage ditches, and nearshore areas in the Hackensack River. The vegetation of the Empire tract is described below.

By letters dated March 11, 1992, November 3, 1997, and April 15, 1998, the New York District USACE confirmed that the vast majority of the Empire tract is regulated as waters of the US with only about 18 acres considered jurisdictional upland. The wetlands vegetation on the Empire tract

is primarily composed of *Phragmites* that grows to a height of 10 to 12 ft, and covers about 90 percent of the site. In fact, *Phragmites* is the most common wetlands plant species in the HMD (Sipple, 1972). Throughout most of the Empire tract (526 acres), *Phragmites* occurs as a dense monoculture (Figure I.C-1, Empire Tract Facing North).

In some very small areas of the Empire tract (totaling less than 17 acres), there are inclusions of other marsh plants (Figure I.C-2, Vegetative Cover Types), typically in association with *Phragmites*. These plant species include panic grass (*Panicum virgatum*), broom sedge (*Andropogon virginicus*), marsh fern (*Thelypteris thelypteroides*), and, in intertidal areas on the river side of the berm system, dwarf spikerush (*Eleocharis parvula*), and smooth cordgrass (*Spartina alterniflora*). The vegetation on the Empire tract is common in northern New Jersey (Robichaud and Buell, 1973; Robichaud, Collins, and Anderson, 1994; USEPA and USACE, 1995).

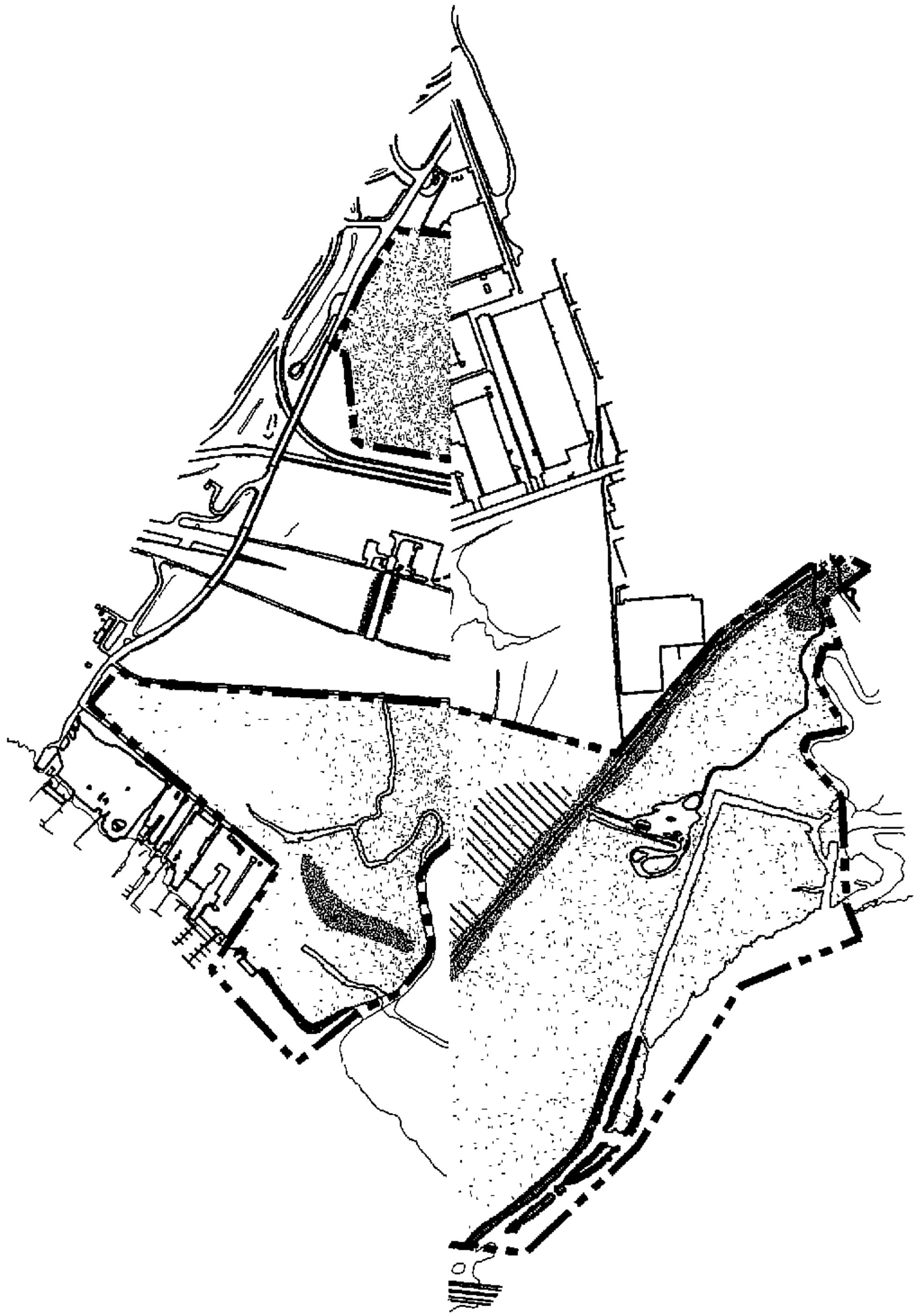
The upland habitat is minimal, and consists of the Transco inspection road, the embankments along the perimeter of the Empire tract, and in small scattered locations throughout the site. On the Empire tract, in a few scattered areas (each less than 0.5 acres), there are upland plant species occurring within jurisdictional wetlands. The upland species that are found on the site include Eastern cottonwood (*Populus deltoides*), tree-of-heaven (*Ailanthis altissima*), staghorn sumac (*Rhus typhina*), elderberry (*Sambucus canadensis*), and multiflora rose (*Rosa multiflora*). Herbaceous plants such as pokeweed (*Phytolacca americana*) and goldenrod (*Solidago* spp.) also occur on the Empire tract.

The shallow water environment on the Empire tract consists of portions of Moonachie Creek, Bashes Creek (Figure I.C-3, Bashes Creek), and Muddabach Creek, and includes some drainage ditches (Figure I.C-4, Surface Waters). Moonachie and Bashes Creeks drain from north to south across the Empire tract. At its southern reach, on the 42-acre parcel, Bashes Creek is separated from the Hackensack River by an earthen berm and its flow is diverted through a ditch to Moonachie Creek. Muddabach Creek branches off Moonachie Creek and generally carries drainage across the northern portion of the Empire tract to a tide gate at the Hackensack River. Portions of these creeks have been channelized by the Bergen County Mosquito Commission to improve the drainage of the site. As a result, the creeks generally are shallow (less than two ft deep), narrow (less than 30 ft wide), and are cut off from tidal flushing. Water levels fluctuate approximately six inches during a year with normal precipitation. The on-site creeks support very little emergent or submergent vegetation.

3.0 <u>Marsh Inverebrates</u>

Marsh surface invertebrates were inventoried at 16 sampling locations (Greiner, 1984). The sampling points used by Greiner were located along the banks of the Hackensack River (three stations) and the on-site creeks (12 stations), and one station was located within a small stand of panic grass (less than one acre). The inventory was conducted using three randomly-located 0.1-sq-m quadrants. Surface debris was moved during sampling, but no excavation was conducted.

Figure I.C-1   Empire Tract Facing North



Property Boundary

Creek

<u>Phragmites australis</u>

Mixed-Species Inclusic

Marsh Fern & <u>Phr</u>

Panic Grass & <u>Ph</u>

Figure LC-2


Figure I.C-3   Bashes Creek

Surface Waters

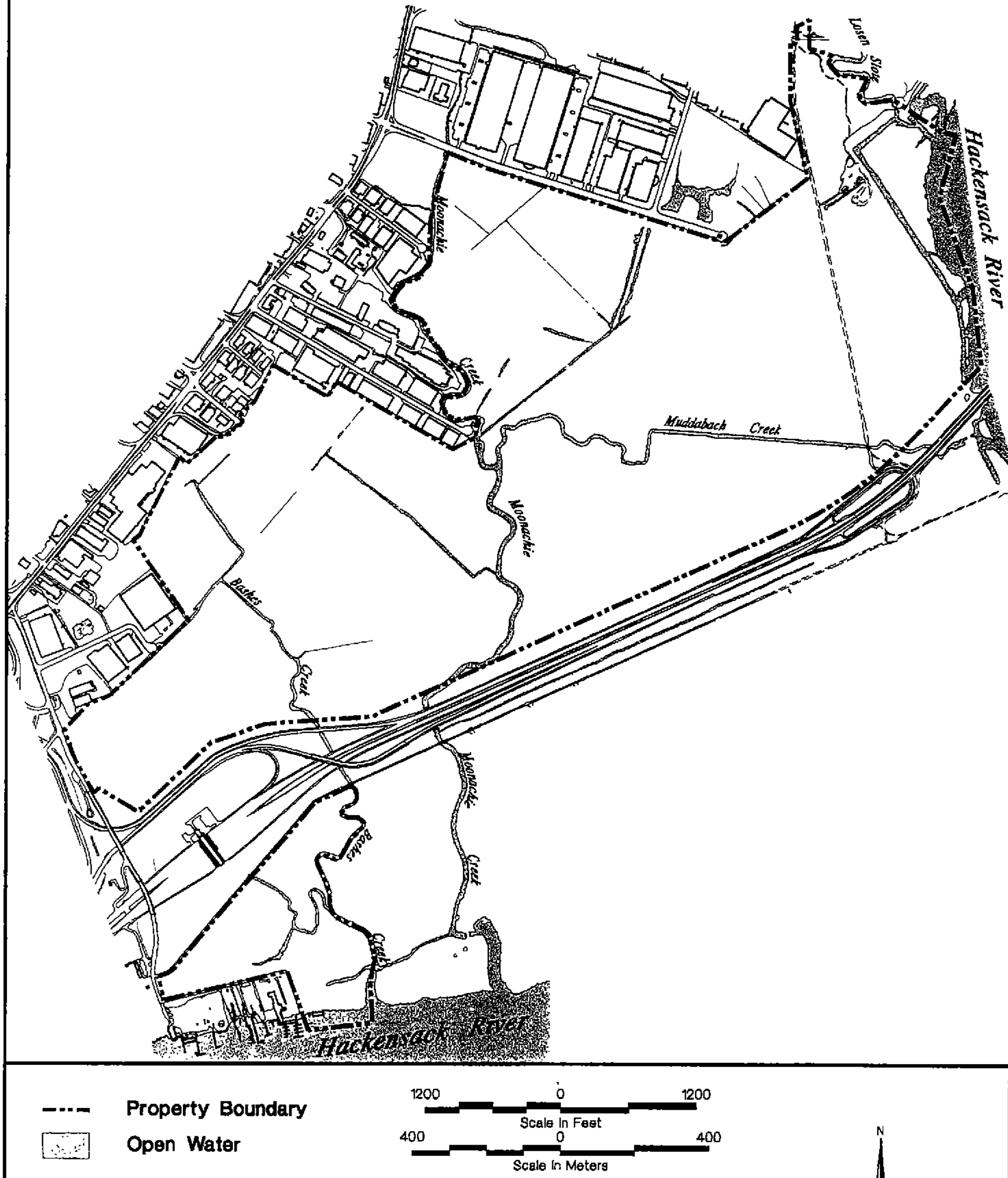


Figure I.C-4

Table I C-1 presents a listing of the invertebrates as reported in the EIAR (HMDC, 1992). The invertebrates found on the Empire tract are associated with several types of habitats. In general, the hydrobid snail, springtail, amphipod, sowbug, and platform mussel (not blue mussel, which is classified as a shellfish species per NJDEP) are associated with open water marsh habitats. Aphids and ladybird beetles are generally associated with the seed heads of common reed. Slugs, crickets, grasshoppers, ants, beetles, and centipedes are generally associated with an upland or transition area from high marsh to drier conditions, and are not typically found in a marsh environment. As seen in Table I.C-1, several species of invertebrates that prefer upland or transitional habitats were found on the Empire tract.

GES found that the diversity and density of those invertebrates associated with open water marsh habitat displayed a decrease with increasing distance from the Hackensack River. The great majority of those taxa were observed at the Hackensack River stations, as opposed to the on-site creek stations. As seen in Table I.C-1, over 95 percent of the springtails and almost 90 percent of the hydrobid snails were collected at the stations adjacent to the river. Similarly, 90 percent of amphipods were identified in the river vegetation sampled. Platform mussels were collected only at the Hackensack River stations.

The most abundant taxa observed along the banks of the on-site creeks were aphids and ants (non-aquatic species). The panic grass area was observed to support aphids and centipedes. The creek stations featured the other taxa that tend to occur in upland or transitional habitats (e.g., centipedes, slugs, grasshoppers, spiders, crickets), while none of these taxa were observed at the Hackensack River stations. The area of the Empire tract that is adjacent to the Hackensack River provides suitable conditions to support invertebrates that are associated with open-water marsh habitat, while conditions at the remainder of the site benefit those taxa that tend to occur in upland or transitional habitats.

Table I.C-1

Total Number of Marsh Surface Invertebrates
(number per sq ft)

Invertebrate	Scientific Name	Stations Adjacent to Hackensack River (n=3)	Stations Adjacent to On-Site Creeks (n=12)	Station Within Panic Grass Stand (n=1)
Springtail	*Annurida maritima*	TN[1]	TN[2]	0
Hydrobid Snail	*Hydrobia minuta*	695	93	0
Aphid	Family Aphididae	300	234	15
Ladybird Beetle	*Naemia seriata*	19	30	0
Amphipod	*Orchestria* sp.	27	3	0
Platform Mussel	*Congeria leucopheata*	15	0	0
Marsh Sowbug	*Philoscia vittata*	0	6	0
Centipede	Class Chilopoda	0	22	6
Slugs	Order Stylommatophora	0	35	0
Ants	Family Formidea	0	441	0
Grasshopper	Family Acrydidea	0	22	0
Spider	*Grammonota* sp.	0	6	0
Cricket	*Gryllus* sp.	0	56	0
Beetle	Order Coleoptera	0	3	0

Notes: TN = judged too numerous to count.
HR = Hackensack River station.
[1] Springtails determined to be TN at one HR station (total of 650 at other two stations).
[2] Springtails determined to be TN at one creek station. Observed at five other stations (total of 51).
Source: Greiner, 1984

D. WILDLIFE

A variety of amphibians, reptiles, fish, birds, and mammals are found in the HMD: there are 23 species of invertebrates, 31 species of fish, 10 species of amphibians, 15 species of reptiles, and 24 species of mammals. Over 250 species of birds have been observed in the HMD, including over 60 species which are known to nest there. The marshes in the HMD are used by waterfowl, including over 20 species of ducks. The intertidal mudflats near Sawmill Creek are the feeding ground for over 40 species of shore birds, while ten species of raptors have been observed to feed in the wet meadows, landfills, and fields in the region (USEPA, 1989; USEPA and USACE, 1995).

The wildlife species that occur in the HMD utilize a diversity of habitat types. Some of the animals have general habitat preferences, indicating that they are able to subsist in a variety of habitat types. Some species, however, are highly specialized and occur in only one or two habitat types. According to the SAMP DEIS (USEPA and USACE, 1995), the habitat types that are found throughout the HMD include the following:

- Bay and mudflats;
- Low salt marsh;
- High salt marsh;
- Tidal reed;
- Freshwater marsh;
- Brackish impoundment; and
- Open water.

It is well-known among ecologists that the major determinant of animal species diversity in a given habitat is the degree of structural heterogeneity and plant diversity. For example, censuses of relatively uniform habitat, such as marshes, grasslands, and shrublands, have revealed low bird diversity (Ricklefs, 1993). In a study of New Jersey marsh birds, Burger et al. (1982) demonstrated a positive relationship between increasing avian species richness and high habitat diversity. It therefore follows that habitats that are relatively structurally homogenous and are composed of a low plant diversity have a lower animal diversity than more complex habitats.

As a result of lack of tidal flow and the dominance of *Phragmites australis* as the primary vegetation cover type, the Empire tract is lacking the habitat diversity that is found in the rest of the HMD. Therefore, there are far fewer species of plants and animals which occur on the Empire tract as compared to the HMD as a whole. The relatively low diversity of plants and animals found on site reflects the lack of habitat diversity and structural complexity which occurs there.

1.0 <u>Mammals</u>

From February 1996 through February 1997, TAMS conducted an avian survey on the Empire tract which was designed to assess avifauna, but during which observers also recorded mammalian species. Personnel conducted on-site observations from three transects and five observation towers.

Observations were made during weekly or bi-weekly sampling throughout the one-year survey. During this time, observers noted the occurrence of any mammals encountered on the Empire tract.

In addition, TAMS staff supplemented the 1996-1997 avian survey with a five-day site visit in April 1997. During the five-day mammal survey, biologists searched for mammals by walking the transects developed for the avian survey, the on-site roadways such as the Transco inspection road, paths, and any other accessible areas. Observations of mammalian species included both direct sightings of animals and evidence of the presence of mammals, such as tracks and scat.

The mammal species observed on the site during the 1996-1997 and April 1997 surveys are presented in Table I.D-1. Table I.D-1 also provides an indication of the comparative frequency with which each species was encountered. The most commonly observed mammals were the Norway rat (*Rattus norvegicus*), striped skunk (*Mephitis mephitis*), and the muskrat (*Ondatra zibethicus*). These findings are similar to those of the Greiner (1984) survey.

A survey of muskrat burrows was conducted by TAMS staff in April 1997 at stations along the banks of Moonachie Creek, Muddabach Creek, and Bashes Creek. (Stations corresponded to the benthic sampling stations shown in Figure I.D-1, Biological Sampling Stations). Two 100-foot transects, one on each side of the creek, were established at each of the five stations; therefore, burrows on both banks of each creek were counted. It was generally found that creek banks adjacent to roadways (e.g., where Barrell Avenue meets Moonachie Creek, or where the Transco access road crosses Bashes and Moonachie creeks) do not provide suitable habitat for muskrats. These areas are generally characterized by extremely steep-sided slopes that are dominated by a mixture of thorn/scrub species and *Phragmites* In these areas, muskrat burrows were not observed. Further along the creeks, away from roadways, an average of six burrows per 100 feet were counted (typically three burrows on each side of a creek).

In addition to muskrat burrows, muskrat huts were counted. The occurrence of a fire on April 7, 1997 on the 542-acre parcel, in an area adjacent to the New Jersey Turnpike, facilitated an unobstructed view of an approximately 50-acre burned area. A total of 34 small-sized muskrat huts were counted within the formerly dense stand of *Phragmites* in the burned area. Permanent huts are typically constructed near water bodies, although muskrats will build temporary smaller huts, often used by juveniles, in dense vegetation (Smith, May 6, 1997).

2.0 Birds

Several surveys of the birds of the HMD have been published. HMDC (1992) staff scientists have compiled a species list for the entire HMD which includes over 250 species of birds occurring within the District, and 66 species that have bred there. This list is reported in the DEIS for the SAMP (USEPA and USACE, 1995). The avian survey performed by TAMS in 1997 for the Empire tract specifically is summarized herein.

Biological Sampling Locations

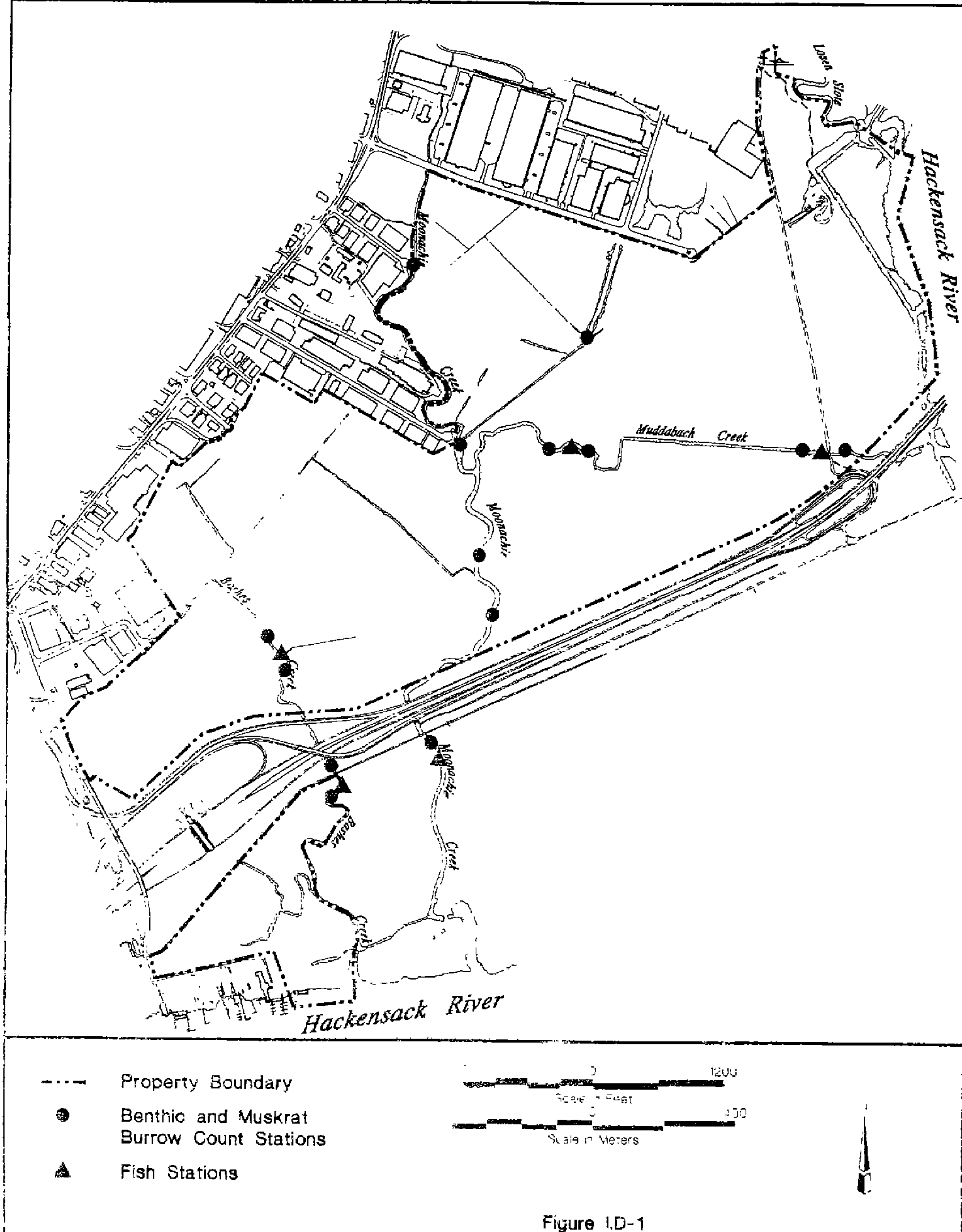


Figure I.D-1

Table I.D-1

Mammals Observed on the Empire Tract

Common Name	Scientific Name
Norway rat	*Rattus norvegicus*
Striped skunk	*Mephitis mephitis*
Muskrat	*Ondatra zibethicus*
Racoon	*Procyon lotor*
Eastern cottontail	*Sylvilagus floridanus*
Eastern gray squirrel	*Sciurus carolinensis*
Meadow vole	*Microtus pennsylvanicus*
Woodchuck	*Marmota monax*
Cat	*Felis domesticus*
Eastern chipmunk	*Tamias striatus*
Sources: Field observations conducted by TAMS from February 1996 to April 1997.	

The TAMS avian survey methodology, as approved by the USACE, USEPA, USFWS, HMDC, and NJDEP, was designed to intensively study and precisely quantify habitat utilization at a single site, rather than the 32 sites studied by the NJAS. The methodology necessitated that a team of TAMS biologists return to numerous pre-established sampling locations on the Empire tract at weekly or bi-weekly intervals (see below) for twelve months. These sampling locations (five 16-ft- high towers and three transects which traversed the site, ranging in length from 2,000 to 3,600 ft) allowed biologists to observe bird habitat utilization on the site. Additionally, TAMS biologists recorded data simultaneously from each tower, and were in radio contact to confirm bird sightings and to minimize redundant bird observations.

Avian Habitat Analysis

As would be expected in any *Phragmites*-dominated marsh habitat, the Empire tract does not have a structurally complex habitat, nor does it have a high vegetative diversity as compared to the HMD as a whole (USEPA and USACE, 1995). While the dense *Phragmites* on site provides cover and perching surfaces for some passerine species, the simplicity of the habitat (in terms of structural complexity and vegetative diversity) is expected to result in a fairly low-diversity bird community of "Permanent Residents" and "Summer Residents" on site. In addition, the *Phragmites* dominating the site does not provide a direct food resource for all but a few species of birds. For example, a few species of passerines, such as Red-winged Blackbird (*Agelaius phoeniceus*), may eat insects that occur on or near *Phragmites*.

The creeks on the Empire tract are narrow bodies of water with limited water movement. Furthermore, the creeks do not have low vegetation adjacent to their banks, as do some other creeks in the HMD (Wargo, 1989; USEPA and USACE, 1995). Instead, the creeks traverse directly through the *Phragmites* coverage and, indeed, seem to be surrounded by a 'wall' of *Phragmites* dropping directly into the shallow water (see Figure I.C-3). The creeks support virtually no emergent or submergent vegetation, which are sources of shelter and food for most water-dependent bird species, and few benthic invertebrate or fish food resources. Thus, there is expected to be a clear relationship between the limited amount of shallow water habitat on-site and minimal resource levels (from the perspective of a water-dependent bird) and the low number of water-dependent avian groups, such as wading birds, shorebirds, and waterfowl (e.g., ducks and geese) observed in this habitat

Complex habitats composed of high vegetative diversity have been conclusively linked to higher avian species diversity (Ricklefs, 1993; USEPA and USACE, 1995). There is extensive documentation in the scientific literature demonstrating that lack of habitat diversity results in a decrease of avian diversity. In New Jersey, for example, Burger et al. (1982) associated avian species richness, density, and biomass with the amount of surface water on a marsh. They stated that "it is clear that diversity in salt marsh types is essential to the fulfillment of the different habitat requirements of different bird groups." Additionally, they noted that conservationists should utilize the technique of creating more open waters to increase habitats for migratory and other avian species.

Daiber (1982) and Moller (1975) also demonstrated that changes in avian diversity over time are related to changing heterogeneity of species habitat. They found that as the height of vegetation in a study plot increased, the gulls and ducks departed the site due to a decrease in habitat heterogeneity. The social gulls and terns were the first to depart, followed by the waders as the vegetation became denser and taller. Forage areas for a variety of species generally declined because of the development of a reed marsh. As the site continued to mature, a shift from breeding ducks and waders to a few passerine species at high densities was recorded. They concluded that a variety of habitat niches must be provided to maintain high avian species diversity of waders, ducks, gulls, terns, and passerines.

As discussed earlier, the wildlife species that occur in the HMD utilize a diversity of habitat types. Furthermore, the SAMP DEIS (USEPA and USACE, 1995) states that there are seven habitat types found throughout the HMD. The Empire tract is comprised of 20 acres of small upland areas and 572 acres of wetlands and aquatic habitats. Common reed (*Phragmites australis*) habitat comprises about 90 percent of the Empire tract and 94 percent of the on-site wetland and aquatic habitats. In terms of the seven wetland and aquatic habitats identified in the HMD, therefore, habitat diversity on the Empire tract is low. Relatively few species of wetland-dependent birds are adapted to utilize the dominant habitat, common reed. Therefore it was anticipated, and subsequently confirmed by the TAMS year-long study, that a significantly lower diversity of wetland-dependent birds would occur on the Empire tract as compared to the wetland-dependent species that are known to utilize other wetland habitats in the HMD.

Avian Survey

An avian survey was conducted by TAMS from February 1996 through February 1997 to evaluate avian utilization of the Empire tract. The survey was designed to include the breeding season and the spring and fall migrations The general findings of the survey are summarized below. Federal and state-listed threatened and endangered birds are discussed later in this chapter.

Observers used two primary sampling methods to collect avian data during the TAMS survey:

- Mobile sampling consisted of observers simultaneously recording all birds sighted or heard at regular intervals along one of three established transects; and

- Fixed-point surveying involved observers simultaneously recording all birds sighted or heard from five elevated observation towers.

Resident Species

"Permanent Residents"

There were 29 species observed on the Empire tract which are considered "Permanent Residents." As per Leck (1975, 1984), individuals of "Permanent Resident" species are present year round in

New Jersey. By far, the most commonly observed "Permanent Resident" species on the Empire tract was the Red-winged Blackbird, which observers counted 8,054 times, representing 62 percent of "Permanent Resident" bird observations. It is very unlikely, however, that 8,054 individual Red-winged Blackbirds were observed. Likewise, the number of recorded observations of other species probably exceeds the number of individuals of birds on the Empire tract. The number of birds recorded does not necessarily reflect the total number of individual birds using the site; the same birds may have been recorded during different observation periods on different days.

The eight most commonly observed "Permanent Resident" species of birds accounted for a total of 93 percent of the "Permanent Resident" bird observations (12,199 of the 13,065 total) recorded during the survey. This is an expected finding, as most ecological communities are dominated by a few common species with many uncommonly sighted species making up the balance. Figure I D-2 (Abundance of "Permanent Resident" Bird Species) is a histogram of the number of observations of these eight most common species as compared to the other 22 "Permanent Resident" species.

"Summer Residents"

There were 28 species observed on the Empire tract that are considered "Summer Residents." "Summer Residents" are present during the summer months in New Jersey (Leck 1975, 1984). The most commonly observed "Summer Resident" species was the Swamp Sparrow (*Melospiza georgiana*). There were 1,787 observations of Swamp Sparrows, representing 38 percent of "Summer Resident" bird observations.

The eight most commonly observed "Summer Resident" species of birds accounted for a total of 91 percent of the "Summer Resident" bird observations (4,297 of the 4,718 total) recorded during the survey. As with the "Permanent Resident" species, this finding further indicates that the avian ecological community of the Empire tract is dominated by only a few commonly observed species with many less commonly observed species making up the balance. Figure I.D-3 (Abundance of "Summer Resident" Bird Species) is a histogram of the number of observations of the eight most commonly observed species as compared to the other 20 "Summer Resident" species.

- American Goldfinch (*Carduelis tristis*)
- American Robin (*Turdus migratorius*)
- Canada Goose (*Branta canadensis*)
- Common Yellowthroat (*Geothlypis trichas*)
- European Starling (*Sturnus vulgaris*)
- Gray Catbird (*Dumetella carolinensis*)
- Red-winged Blackbird (*Agelaius phoeniceus*)
- Ring-necked Pheasant (*Phasianus colchicus*)
- Song Sparrow (*Melospiza melodia*)
- Swamp Sparrow (*Melospiza georgiana*); and
- Yellow Warbler (*Dendroica petechia*).

Abundance of Permanent Residents

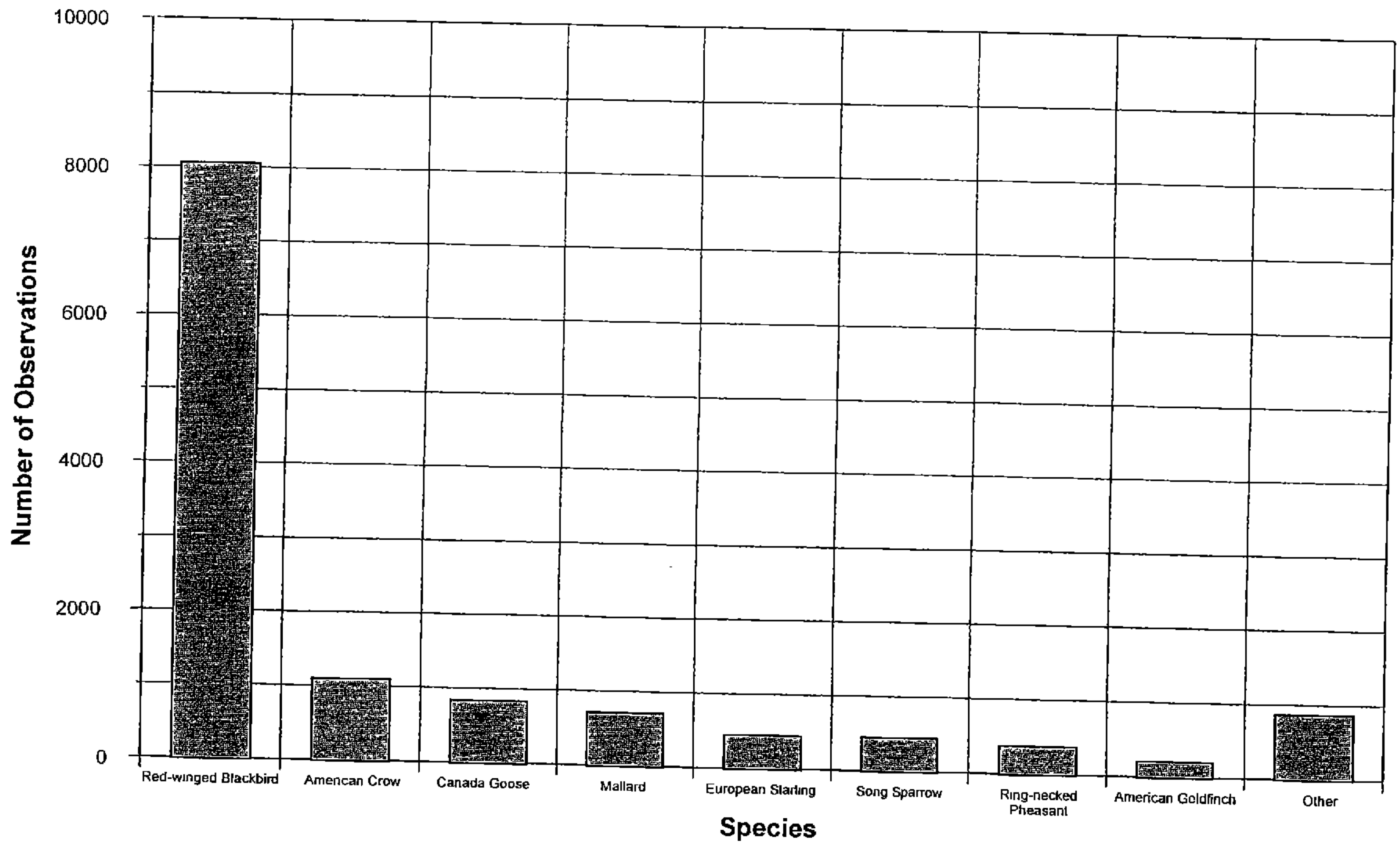


Figure I.D-2

Abundance of Summer Residents

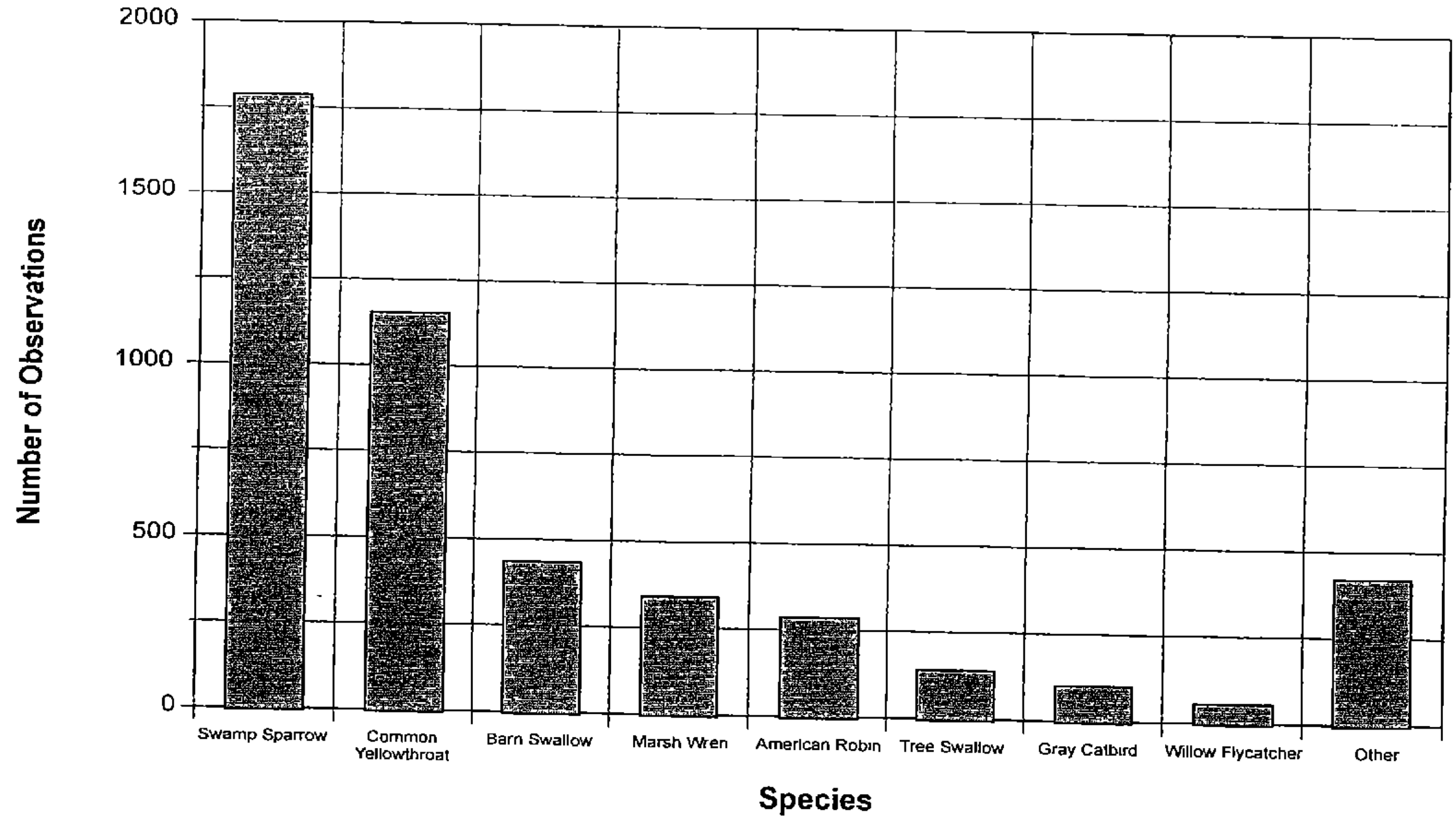


Figure I.D-3

Habitat Utilization

For the purposes of the TAMS avian survey, three general habitat types were identified *a priori*, and bird utilization of these habitat types was quantified. These three types are wetlands, uplands, and shallow water areas. The discussion below focuses on these general habitat types and the above-described species that utilize them. Some bird species were observed in more than one habitat type. As discussed below, the findings of the avian survey indicate that the Empire tract does not provide the food and habitat resources required for the site to support most of the 250 species of birds that have been observed in the HMD.

Birds associated with estuarine habitats were not commonly observed at the site. Only 33 percent of the total bird species that were observed on site are considered wetland species. This is clearly due to the limited amount of shallow water habitat available at the site.

Given the lack of habitat diversity and the poor ecological quality of the on-site creeks (in terms of water flow, vegetative resources for food and shelter, and aquatic invertebrate density for food resources), the Empire tract is of a lower value to water-dependent avian groups than many other sites in the HMD, such as the Sawmill Creek Wildlife Management Area (Kane and Githens, 1994; USEPA and USACE, 1995) and the Hartz Mountain 158-acre mitigation site adjacent to Mill Creek and Cromakill Creek (Wargo, 1989). Indeed, the Empire tract provides limited habitat to the water-dependent groups that require shallow water/mud flats to meet their ecological life requirements. In fact, only two of the commonly observed species of "Permanent Residents" or "Summer Residents" (Canada Goose, Mallard) belong to any of the four avian groups that typically characterize an estuarine marsh: waders (e.g., egrets and herons), shorebirds (e.g., sandpipers and plovers), waterfowl (ducks and geese), and gulls and terns.

Wetland Habitat Utilization

Over 93 percent of seasonal and resident species were observed in the *Phragmites*-dominated wetland habitat. As previously described, *Phragmites* is found on about 90 percent of the Empire tract, and therefore it is not surprising that most species of seasonal and resident birds were observed at least one time in this habitat. Prevailing utilization of the site is dominated by those species of passerines that are well-suited to dense cover. For example, Red-winged Blackbirds, Common Yellowthroat, American Crows, and European Starlings are seen in greater abundance in this habitat than are any other species.

As stated previously, the most commonly observed species was the Red-winged Blackbird, which TAMS ecologists counted 8,054 times. Ninety-four percent of these observations were of the blackbird in *Phragmites* habitat, reflecting both the dominance of the *Phragmites* habitat and the habitat preference of blackbirds. Other species also demonstrated a preference for the wetland habitat. Ninety-nine percent of Swamp Sparrow observations, 95 percent of Common Yellowthroat observations, 86 percent of the Mallard observations, and 90 percent of the Canada Goose observations were in the habitat considered by observers to be wetlands habitat.

Upland Habitat Utilization

The greatest diversity of birds, on a per acre basis, was in the upland habitat (approximately 18 acres scattered in seven locations throughout the site; see Figure I.C-2), which accounts for less than five percent of the site. The upland habitat is primarily located along the Transco inspection road and near the very edges of the property, and consists of fill material on which a variety of common upland plant species occur. Sixty-four percent of all seasonal and resident species of birds were observed in these upland areas. Over 30 of these species were woodland passerines, including wrens, warblers, sparrows, and flycatchers. American Crow and Red-winged Blackbirds, both "Permanent Residents," combined accounted for 45 percent of the upland observations.

Shallow Water Habitat Utilization

Approximately 23 percent of all seasonal and resident species of birds observed were utilizing shallow water habitat, which also accounts for less than five percent of the site. The shallow water areas, which are not contiguous, largely consist of the three creeks described earlier, as well as a few drainage ditches with some *Phragmites* present. In general, and as expected, the creeks are not widely utilized by the water-dependent bird species.

Fifteen species of waterbirds comprised the birds observed in shallow water habitat. The most commonly observed species in shallow water was the Mallard, followed by the Canada Goose, together accounting for about two-thirds of all shallow water observations. Only three species were found in shallow water and in no other habitat: American Coot (*Fulica americana*), Pied-billed Grebe (*Podilymbus podicepsm*), and Spotted Sandpiper (*Actitis macularia*), all seen in very low numbers.

3.0 Fish

A survey was conducted on the Empire tract during which fish were sampled at Bashes Creek, Muddabach Creek, and Moonachie Creek (Figure I.D-1) on April 7, 8, and 9, 1997. At each of five fish collection stations, a gill net was deployed and left overnight for a period of 15 to 17 hours. The net featured five panels of varying mesh sizes ranging from 0.5 to 2 inches. All fish collected were counted, identified, and measured

Table I.D-2 presents information on the fish collected within the Empire tract via gill net during the April 1997 sampling effort. Four fish species were collected, as follows:

- Common carp (*Cyprinus carpio*);
- Brown bullhead (*Ictalurus nebulosus*);
- Pumpkinseed (*Lepomis gibbosus*); and
- Mummichog (*Fundulus heteroclitus*).

There is no known harvesting of fish on the Empire tract.

Table I.D-2 describes the number of each species collected, and provides the mean length and minimum and maximum lengths of sampled fish. To document field conditions during fish sampling, concurrent in-situ water quality measurements (temperature and dissolved oxygen) were collected at each station during the fish sampling. These measurements are presented in Table I.D-3.

Fish

The Hackensack Meadowlands Development Commission (HMDC) aquatic inventory study (HMDC, 1989) was reviewed to determine the species composition of fish within the Hackensack River adjacent to the Empire tract. Two methods of sampling were used to collect fish from the Hackensack River near the Empire tract: trap nets and seines. The inventory, which was conducted throughout the HMD from 1987 through 1988, featured two Hackensack River sampling stations adjacent to the Empire tract that were referred to as Trap Net 5 (TN 5) and Seine 4 (S4). Trap Net 5 was located on the western bank of the river near the mouth of Losen Slote (at the northern extent of the Empire tract's frontage on the Hackensack River), while S4 was located on the western bank of the river just below the New Jersey Turnpike's (NJT) Western Spur. A total of 14 species of fish (which include the four species collected at the Empire tract by TAMS during the April 1997 survey) were collected, as shown in Table I.D-4.

Since all but 22 acres of the 584-acre Empire tract is, under normal circumstances, cut off from the Hackensack River by berms and tide gates, brackish marsh conditions do not occur on the Empire tract as would be expected at a wetland within the HMD with comparable elevations. Since the Empire tract is hydraulically isolated from the river, there is *no* direct access for the fish in the river to the site.

In its existing condition, only the creeks of the Empire tract provide fish habitat. These creeks comprise only 15 acres (three percent) of the 584-acre Empire tract. Many of the life requirements of the 14 species found in the Hackensack River adjacent to the site are dependent upon the use of *inundated* vegetated marsh habitat with expanses of shallow water. Thus, the Empire tract, in its existing condition, does not provide suitable habitat to meet the life requirements of most of these species. Table I.D-5 presents the current utilization of the Empire tract with respect to these requirements, which are described as follows:

- **Feeding** -Suitable feeding sites may be determined or influenced by the home range of a species, the availability of its food supply, and the presence of suitable cover (Daiber, 1982);

- **Shelter** - Shelter refers to the suitability of a site to provide protection to a species from its predators (i.e., larger piscivorus fish and wading birds). Partially submerged wetland plants provide optimal shelter environments. Cover can also be provided by overhanging trees, logs, bottom sediments, undercut banks, and turbidity (Marble, 1992);

Table I.D-2

Fish Collected on the Empire Tract - April 1997

Station	Species	No. Collected	Mean length (cm)	Minimum length (cm)	Maximum length (cm)
BC 1	Common carp Brown bullhead Pumpkinseed Mummichog	5 2 1 6	33.0 20.5 9.5 9.0	14.3 20.0 9 5 8.7	61.5 21.0 9.5 9.5
BC 3	Common carp Brown bullhead Mummichog	12 1 29	26.7 28.5 9.1	8.3 28.5 8.5	52.0 28.5 10.0
MUDD 2	Common carp Brown bullhead Mummichog	6 4 2	46.6 28.0 9.0	26.5 27.0 9.0	80.0 29.0 9.0
MC 1	Common carp Brown bullhead Mummichog	1 2 6	66.5 27.3 9.0	66.5 27.0 8.8	66.5 27.5 9.0
MUDD 3**	Mummichog	10	9.0	9 0	9 0

Notes:
1. Collected via gill net
2. ** Water less than three inches deep at this stretch of Muddabach Creek
3. BC = Bashes Creek; MUDD = Muddabach Creek; MC = Moonachie Creek
4. Sampling conducted by TAMS during the week of April 7, 1997

Table I.D-3

Water Quality Measurements at Empire Tract Fish Sampling Stations - April 1997

Fish Station	Date	Temperature (°C)	Dissolved Oxygen (ppm)
BC 1	4/8/97	10	6.0
BC 3	4/8/97	12	7.2
MUDD 2	4/7/97	15	2.7
MC 1	4/8/97	10	4.7
MUDD 3	4/9/97	10.5	9.8

Notes: BC = Bashes Creek; MUDD = Muddabach Creek; MC = Moonachie Creek
Source: In-situ water quality measurements using YSI meters

Table I.D-4

Fish Collected Off-Site at Hackensack River Stations Adjacent to the Empire Tract

Common Name	Scientific Name	Trap Net	Seine
Alewife	*Alosa pseudoharengus*	●	
Black crappie	*Pomoxis nigromaculatus*	●	
Blueback herring	*Alosa aestivalis*	●	
Brown bullhead	*Ictalurus nebulosus*	●	
Carp	*Cyprinus carpio*	●	
Gizzard shad	*Dorosoma cepedianium*	●	●
Golden shiner	*Notemigonus chrysoleucus*	●	
Inland silverside	*Menidia beryllina*		●
Mummichog	*Fundulus heteroclitus*	●	●
Pumpkinseed	*Lepomis gibbosus*	●	●
Spot	*Leiostomus xanthurus*	●	
Striped killifish	*Fundulus majalis*		●
Weakfish	*Cynoscion regalis*	●	
White perch	*Morone americana*	●	●
Source: Based upon HMDC, 1989			

Table I.D-5

Fish Utilization of Existing Empire Tract

Fish	Feeding	Shelter	Spawning	Nursery
Alewife				
Black crappie				
Blueback herring				
Brown bullhead	●	●	●	●
Carp	●	●	●	●
Gizzard shad				
Golden shiner				
Inland silverside				
Mummichog	●	●	●	●
Pumpkinseed	●	●	●	●
Spot				
Striped killifish				
Weakfish				
White perch				

Notes: ● indicates that the Empire tract's creeks fulfill the specific function

Sources: Species utilization of Empire tract based upon TAMS 1997 on-site fish sampling; Life requirement information based upon Lippson and Lippson (1997); Mitsch and Gosselink (1993); and Daiber (1982)

- **Spawning** - A spawning habitat is an area that is suitable for a species to deposit its eggs and produce offspring; and

- **Nursery** - Nursery habitat, or "nursery grounds," is defined as habitat that provides an abundant food source and vegetated shallow water habitat to serve as shelter for *juvenile* fish species during their development (Carlson and Fowler, 1979).

A description of the general requirements of the 14 known species of fish from the Hackensack River adjacent to the Empire tract, and their use of the overall estuary is presented herein.

Killifish

Killifish include the mummichog (*Fundulus heteroclitus*) and the striped killifish (*Fundulus majalis*). Both species are found throughout the Hackensack River estuary, as they have a broad salinity range (Lippson and Lippson, 1997). The mummichog is, by far, the most abundant of all fish species in the estuary Various age groups of both species, from newly hatched larvae to adults, school close to shore at the edge of marshes. At low tides, killifish lie near the bottom of creeks, while at high tide they move into marshes to feed opportunistically on whatever food is available (Mitsch and Gosselink, 1993). Killifish are permanent residents in the estuary and they have a small home range along the banks of tidal creeks of approximately 30 meters (Daiber, 1992). Spawning sites are diverse and eggs have been observed within silt at the bottom of creeks, within empty shells and other debris, and within tidal marshes on vegetation (such as on the primary leaves of cord grass) (Daiber, 1982).

Inland Silverside

The inland silverside (*Menidia beryllina*) is an inshore species that is typically observed in association with killifish. It too, is a schooling species that moves into marshes at high tide to feed. Like killifish, the inland silverside has a small home range and is a year-round resident of the estuary. The spawning season is from May to July and eggs are deposited on creek bottoms and within marshes (Geiser, 1984).

Herrings

Two herring species, the alewife (*Alosa pseudoharengus*) and the blueback herring (*Alosa aestivalis*), were observed by the HMDC in the river adjacent to the Empire tract. These species are anadromous fishes; that is, they are ocean-living species that migrate into freshwater rivers to spawn. Spawning occurs in the open areas of large rivers (Lippson and Lippson, 1997). The adults move downstream after spawning, and by summer most have returned to the ocean. Concurrently, the young hatch and grow rapidly through the spring and summer in the tidal fresh and brackish waters. Tidal marshes serve as major nursery grounds for these species. Juveniles are found in peak abundance in these marshes, where they feed on small invertebrates (Mitsch and Gosselink, 1993). As they develop, they gradually migrate downstream.

Gizzard Shad

The gizzard shad (*Dorosoma cepedianium*) is a common herbivorous fish associated primarily with freshwater habitats (Neiring, 1985). However, it also can behave like an anadromous species in that many individuals spend most of the year downstream in moderately salty water and migrate upstream to the tidal freshwater portion of the river to spawn. The young then migrate downstream into brackish waters (Lippson and Lippson, 1997). The gizzard shad is a prime forage fish for larger carnivorous fish (Neiring, 1985).

White Perch

Like the herring and shad discussed above, the white perch (*Morone americana*) must also seek freshwater to spawn. It is truly an estuarine species that never occurs in the ocean (Lippson and Lippson, 1997) It is referred to as "semi-anadromous" as individuals do not migrate all the way from the ocean, like the truly anadromous species, but from the brackish downstream portions of tidal rivers (Lippson and Lippson, 1997). Spawning occurs in the open freshwater areas of rivers. In spring, after spawning, adults migrate back downstream. Concurrently, in the upstream spawning areas the eggs hatch and juveniles use marshes as nursery grounds, where they seek shelter and feed (Mitsch and Gosselink, 1993). As they begin to mature, the young migrate downstream to brackish waters (Lippson and Lippson, 1997).

Spot and Weakfish

The spot (*Leiostomus xanthurus*) and the weakfish (*Cynoscion regalis*) are ocean species that enter estuaries in the spring and summer to feed (Lippson and Lippson, 1997). While both are ocean spawners, the hatched larvae and juveniles enter estuaries and tidal rivers at an early age (Lippson and Lippson, 1997) and use marsh habitats as nursery grounds (Daiber, 1982). There, they grow rapidly on the dense populations of invertebrates and small forage fish (e.g., killifish, silversides, shad) that inhabit marshes (Lippson and Lippson, 1997). Spot and weakfish generally return to the ocean in autumn (Lippson and Lippson, 1997).

Freshwater Fishes

Five of the 14 species of fish that were identified by the HMDC adjacent to the Empire tract are considered freshwater fishes (Lippson and Lippson, 1997):

- Black crappie (*Pomoxis nigromaculatus*);
- Brown bullhead (*Ictalurus nebulosus*);
- Carp (*Cyprinus carpio*);
- Golden shiner (*Notemigonus chrysoleucus*); and
- Pumpkinseed (*Lepomis gibbosus*).

These species are able to tolerate oligohaline conditions and often migrate downstream from freshwater areas of tidal rivers. They tend to congregate in shallow streams and protected coves of the river (Lippson and Lippson, 1997). Some move into the deeper channel waters as well. In spring, freshwater fishes move upstream to spawn.

Shellfish

Shellfish, as defined by the NJDEP (NJAC 7:7E-8.3), include hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), American oysters (*Crassostrea virginica*), bay scallops (*Argopecten irradians*), and blue mussels (*Mytilus edulis*). More generally, shellfish can also apply to invertebrate species that are harvested for human consumption, which would include shrimp and crabs. Based upon field investigations, including the on-site benthic survey, no shellfish species are known to exist within the Empire tract.

The HMDC aquatic inventory study was reviewed to determine the species composition of benthic invertebrates (which include shellfish species) within the Hackensack River adjacent to the Empire tract. No shellfish species, as defined by the NJDEP (i.e., hard clams, soft clams, American oysters, bay scallops, or blue mussels) were reported. In fact, none of these species were observed in the northern portion of the Hackensack River (i.e., north of Route 3) during the HMDC's two-year aquatic survey.

The blue crab is known to occur throughout the tidal Hackensack River and is harvested from the river and its tributaries by area residents (NJTA, 1986) (although the consumption of blue crabs and fish is prohibited by the NJDEP, as mentioned below).

Fishing Industry

Administrative Order EO-40-19 (August 6, 1984) prohibits the sale or consumption of fish and shellfish from the tidal Hackensack River. Despite this ban, people do harvest blue crabs from the river for consumption. Additionally, people have been observed (by TAMS personnel) fishing for carp in the river's tributaries.

While there is no commercial fishing in the Hackensack River, there is a bait fish industry. Mummichogs and grass shrimp (*Palaemonetes pugio*) are harvested and sold as bait outside of the HMD (Smith, March 16, 1998). The Hackensack River estuary also plays an indirect role in the bait fish industry, as there are migratory fish species (i.e., alewife, blueback herring, and gizzard shad) within the river that are known to migrate into commercial fishing grounds outside of the HMD. These migratory species serve as bait for commercially-harvested fish (such as bluefish, weakfish, etc.).

4.0 Reptiles and Amphibians

As with mammals, the on-site herpetofauna were surveyed by TAMS staff during the avian survey (February 1996 through February 1997) and in supplemental surveys conducted during a five day

field visit in April 1997. During the field visit, biologists searched for herpetofauna by walking the transects developed for the avian survey, the on-site roadways such as the Transco inspection road, walking paths, and any other accessible areas.

TAMS searched for herpetofauna during the survey by examining suitable habitats, including banks, ponded areas, underneath debris, and sun-exposed surfaces. Searches were conducted on warm, sunny days when conditions were optimal for herpetofauna, such as turtles and snakes, to be sunning themselves.

In general, the herpetofaunal diversity of the Empire tract is extremely low. Only three herpetofaunal species were identified on site:

- Snapping turtle (*Chelydra serpintina*);
- Eastern painted turtle (*Chrysemys picta*); and
- Eastern garter snake (*Thamnophis sirtalis*).

The snapping turtle and eastern painted turtle were commonly observed sunning on exposed surfaces within the on-site creeks, such as floating logs, or rocks. Remains of fish eaten by snapping turtles were found in gill nets at each station. Garter snakes were often observed in the vicinity of the Transco inspection road.

TAMS staff obtained no direct or indirect evidence of any species of frogs on site during the 1996-1997 surveys.

E. WATER QUALITY/TIDAL INFLUENCE

1.0 Sampling Program, Quantitative Elemental Scan, Marsh Sediments, and Wastewater Outfalls

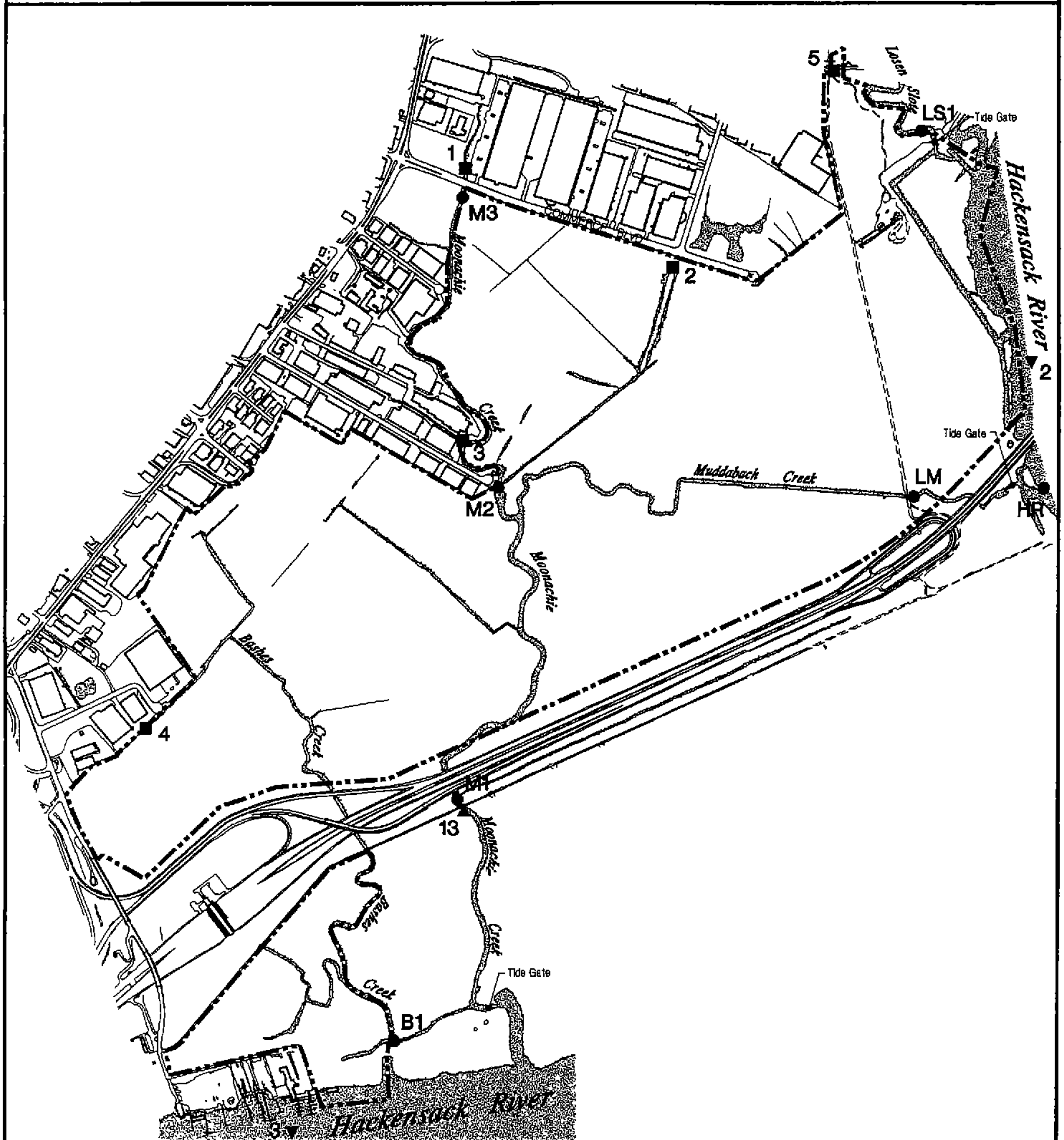
On-Site Investigations

Water quality conditions on the Empire tract are predominantly controlled by point and non-point discharges originating in the Bashes Creek and Moonachie Creek drainage basins in Carlstadt. Since all but 22 acres of the site is, under normal circumstances, cut off from the Hackensack River by berms and tide gates, brackish marsh conditions do not occur on site as would be expected at a meadowlands location with comparable elevations. The function of the berms and tide gates is to prevent river water intrusion while allowing upland storm flows to be discharged when river levels are sufficiently low. Therefore, since the site is largely hydraulically isolated from the river, Moonachie Creek, Bashes Creek, and Muddabach Creek are relatively stagnant drainage courses. Velocities in the creeks are minimal (less than one ft/sec) and water depths are less than two ft during most periods. Many water quality investigations have been conducted on the Empire tract and in the immediate vicinity of the Empire tract since 1978. The results of these studies are documented below.

Dissolved oxygen (DO) concentrations at a sampling station on Moonachie Creek just downstream of the NJ Turnpike, as measured by the HMDC from 1978 to 1988, ranged from 0.1 milligrams per liter (mg/L) to 15 mg/L. This sampling location (HMDC Station 13) is shown in Figure I.E-1, Water Quality Sampling Locations. Annual average concentrations during this period ranged from 2.5 mg/L to 7.8 mg/L. Monitoring at this HMDC station was discontinued in 1988. Many of the instantaneous DO measurements were below the four mg/L water quality criterion specified for New Jersey SE2 (saline estuarine) and FW2-NT (freshwater, non-trout) waters. The low levels of DO were partly due to the lack of flushing in the creeks.

Average annual salinities at this HMDC station ranged from 0.9 to 8.7 parts per thousand (ppt), indicating both fresh and brackish/saline conditions in the creek at various times. The variations in salinity were caused by precipitation events and possibly malfunctioning tide gates and/or groundwater intrusion which may have allowed river water to enter the Empire tract. The portions of the creeks with salinities greater than 3.5 ppt would be classified as SE2, while portions less than or equal to 3.5 ppt would be classified FW2. The Hackensack River near the site is classified SE2. Designated uses associated with SE2 waters include maintenance, migration, and propagation of the natural and established biota; migration of diadromous fish; maintenance of wildlife; secondary contact recreation, i.e., fishing and boating; and other reasonable uses. Designated uses for FW2 waters include the same uses as SE2 waters and also include primary contact recreation, and industrial and agricultural water supply. Water quality criteria have been established to allow the designated-use classifications to be attained.

Water Quality Sampling Locations



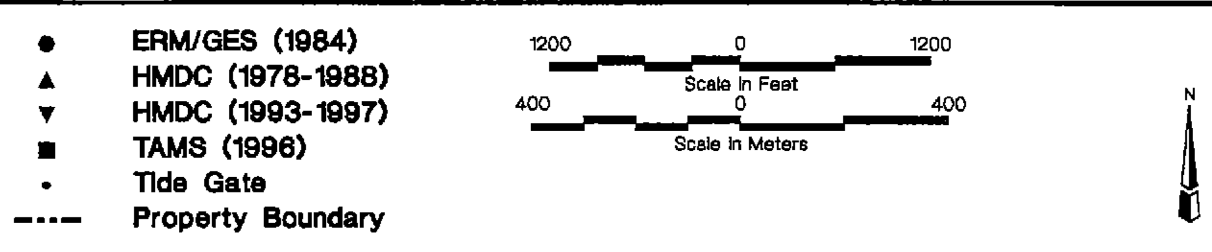


Figure I.E-1

An HMDC-approved water quality sampling program for the Empire tract was conducted in 1984 and results were documented in the report entitled "Water Quality, Wildlife, and Vegetation Assessment for the Empire Tract, Hackensack Meadowlands, NJ" (ERM and GES, February 1985). Surface water and sediment samples were collected in Moonachie Creek (three stations: the upstream [Station M3], midstream [M2], and downstream [M1] limits of the Empire tract), Bashes Creek (downstream limit of the Empire tract [B1]), and Muddabach Creek (downstream limit of the Empire tract [LM]). Each of these stations were located upstream of the tide gates. Surface water samples were also collected just off site in the Hackensack River near the NJ Turnpike bridge (Station HR). These locations are shown in Figure I.E-1. Surface water samples were analyzed for conventional parameters such as salinity, pH, DO, nutrients (phosphorus and nitrogen), biochemical oxygen demand (BOD), and total and fecal coliforms, among others.

The surface water sampling consisted of six surveys conducted at approximately two-week intervals from September to November. The program was developed based on the premise that the tide gates were leaking, allowing some river water into the marsh (HMDC, 1992). For each of the six surveys, river water was collected during flood tide to establish flood water quality while the on-site tributary stations were then sampled during ebb tide of the same cycle to establish any changes in quality after partial residence on site During the next tidal cycle, the river station and on-site tributary stations were also sampled during flood and ebb tides, respectively. Thus, two samples were collected at each station during each survey for a total of twelve samples per location Two of the six survey events followed a five-day period with more than one inch of precipitation.

Table I E-1 provides a summary of the 1984 surface water data for the conventional parameters Salinity measurements in Moonachie Creek near the upstream border of the Empire tract at Commerce Boulevard indicate generally freshwater conditions (ten readings less than 1 ppt, and 2.8 ppt and 3 2 ppt) The higher salinities at this upstream station followed a five-day period without precipitation Conditions were slightly more brackish at the midstream station near Barell Avenue, with salinities ranging from less than 1 ppt to 5.9 ppt at an average value of 2.7 ppt. At the Moonachie Creek downstream station near the downstream side of the NJ Turnpike culvert, salinities ranged from 2.5 ppt to 6.7 ppt, which is consistent with the HMDC 1978 to 1988 data. The downstream stations on Bashes Creek (B1) and Muddabach Creek (LM) also exhibited elevated salinities with respect to the upstream stations on Moonachie Creek. Salinity levels at the downstream stations during wet periods were approximately equal to levels during dry periods. The more saline conditions in the creeks closer to the river appear to have resulted from leaking tide gates, in that salinities at these stations were similar to values measured at the Hackensack River station.

Based on the salinity data set, the FW2 classification could be adapted for the Moonachie Creek upstream and midstream stations. Therefore, data for these two stations are grouped together in Table I E-1. For the downstream station on Moonachie Creek, as well as the Bashes Creek and Muddabach Creek stations, the SE2 classification would be more appropriate based on salinity measurements during the sampling period.

Table I.E-1

Water Quality - Conventional Parameters Concentrations (ERM/GES 1984 Data)

Parameter	Unit	NJ Surface Water Criteria	Hackensack River (Station HR)	Bashes Creek - Downstream (Station B1)	Moonachie Creek- Upstream and Midstream (Stations M3, M2)	Moonachie Creek- Downstream (Station M1)	Muddabach Creek- Downstream (Station LM)
Class	–	–	SE2	SE2	FW2	SE2	SE2
Salinity	ppt	≤3.5 (FW2) >3.5 (SE2)	4.0-9.2	2.5-7.2	<1-5 9	2.5-6.7	3.5-8.8
pH	–	6. -8.5	6.8-7.2	6.7-7.8	6.6-8.9	6.8-7.8	6.9-7.3
DO	mg/L	4 0 (min)	2 8-6.4	4.8-11.3	3.0-14.8	4.1-15.5	2.6-7.8
BOD_5	mg/L	25 [1]	7-15	6-17	4-22	7-18	8-16
TSS	mg/L	40	10-32	15-94	10-104	13-60	10-60
Turbidity	NTU	50 (FW2) 30 (SE2)	7-9	8-25	11-38	9-25	8-12
Fecal Coliform	#/100mL	200(FW2) 770(SE2)	100-4,900	<100-800	<100-3,200	<100-500	100-2,200
Total Coliform	#/100mL	5,000 [1]	2,000- >80,000	1,900- 19,000	2,000- 110,000	1,000- >80,000	2,000- >80,000
Phosphate	mg/L	30 [1]	2.0-5.1	1.1-2.4	0.4-5.8	1.1-2.3	2.3-5.1
Total Nitrogen	mg/L	30 [1]	2-10	3-6	<1-6	<1-8	3-8

Note: 1. HMDC discharge limitation from ERM/GES 1985; NJ surface water standard not established
Source: Data from ERM/GES 1984, NJ Surface Water Criteria from NJAC 7:9B-1.14

Dissolved oxygen concentrations at the Moonachie Creek upstream and midstream stations, as well as the Muddabach Creek station, fell below the 4 mg/L criterion on at least two occasions. As expected, daylight DO measurements were generally greater than measurements taken following the overnight period when increased oxygen utilization occurs due to algae respiration. In fact, all of the DO measurements that were less than the minimum criterion were taken following the overnight period. Dissolved oxygen concentrations in the creeks were generally greater than concentrations in the river, suggesting that the Empire tract may export DO to the river (ERM/GES, 1985). Total suspended solids (TSS) concentrations in the on-site creeks exceeded the 40 mg/L criterion on numerous occasions. Turbidity levels did not exceed the "at any time" criteria for either the SE2 or the FW2 stations. Turbidity levels and TSS concentrations were generally greater at the on-site creek stations than in the river. At each of the creek stations, BOD_5 concentrations were less than HMDC's discharge limitation of 25 mg/L (there is no established New Jersey surface water standard for this parameter).

Fecal coliform levels at the Moonachie Creek upstream and midstream stations exceeded the FW2 criterion, whereas the more brackish Moonachie Creek downstream station did not exceed the SE2 criterion. Fecal coliform levels in the other creeks on the Empire tract exceeded the SE2 criterion. The source of coliforms in the on-site creeks is most likely stormwater runoff, a conclusion that is supported by the fact that coliform levels were generally higher following rain events. Total coliform levels were generally greater at the upstream and midstream stations on Moonachie Creek due to their proximity to the stormwater outfalls when compared to the downstream station. The coliform exceedances indicate that primary contact recreation, a designated use of FW2 waters but not SE2 waters, would create a human health hazard (ERM/GES, 1985). Total phosphorus as phosphate measurements indicate that the river is a source of this nutrient. HMDC's discharge limitations for total phosphorus and total nitrogen were not exceeded at any station.

Select heavy metals, including cadmium, chromium, copper, lead, mercury, nickel, and zinc were analyzed in surface water and sediment in the on-site creeks during the 1984 investigation. Four of the metals, including cadmium, copper, lead, and nickel, were not detected in the surface water samples Mercury was only detected off site in Losen Slote water at a concentration of four micrograms per liter (µg/L). It should be noted that the detection limit for mercury in this study (1 µg/L) was greater than the New Jersey surface water criteria for both FW2 and SE2 waters (0.144 µg/L and 0.146 µg/L, respectively). Chromium was detected in ten of the twelve surface water samples at the Moonachie Creek midstream station near the terminus of Barell Avenue, at concentrations ranging from 70 µg/L to 2,050 µg/L (FW2 standard of 160 µg/L). Chromium was detected in one of the twelve surface water samples collected at the Moonachie Creek upstream station at a concentration of 60 µg/L. Chromium was not detected at the other stations (50 µg/L detection limit). Concentrations of zinc in the on-site creeks ranged from 10 µg/L to 80 µg/L (170 µg/L USEPA criterion). The sources of metals to the Empire tract include stormwater runoff and possibly industrial wastewater discharges. It can be expected that the metals in the water column will partially adsorb to suspended matter and settle to the sediment.

The metals data from sediment collected from the on-site creeks in 1984 are summarized in Table I.E-2. NJDEP's soil cleanup criteria and National Oceanic and Atmospheric Administration's (NOAA) biological effects concentrations are used for comparison purposes, as sediment criteria have not been published for New Jersey. As shown in Table I.E-2, sediment concentrations of all parameters for which a criterion is available are less than their respective NJDEP soil cleanup criteria. Chromium was detected in Bashes Creek and Moonachie Creek at concentrations greater than NOAA's Effects Range-Median (ER-M) value.

Lead and mercury were detected at concentrations slightly greater than the NOAA ER-M values. The metals detected in on-site sediments are commonly detected in stormwater runoff.

In the summer of 1991, TAMS conducted on-site sampling consisting of field measurements of salinity and temperature in surface water and groundwater at numerous locations throughout the Empire tract. Salinity measurements were less than 1 ppt in Moonachie Creek at the upstream boundary of the Empire tract and in the creek down to its confluence with Muddabach Creek. Salinity was also less than 0.5 ppt in ditches at the western perimeter of the Empire tract which receive runoff from off-site areas in the Bashes Creek and Moonachie Creek basins. Salinities in the creeks near the NJ Turnpike and closer to the Hackensack River were higher, suggesting that the tide gates on Moonachie and Muddabach Creeks allowed brackish river water to enter the Empire tract in 1991. In Bashes Creek between the NJ Turnpike and the river, salinities ranged from 2.0 ppt to 8.5 ppt. In Moonachie Creek near the NJ Turnpike, salinities ranged from 1.1 ppt to 8.0 ppt. In Muddabach Creek near the NJ Turnpike and the on-site Transco road, salinities ranged from less than 0.5 ppt to approximately 5.0 ppt.

In March 1996, during a rain event, TAMS sampled discharges from outfalls and surface water from ditches and creeks at five locations at the western and northern boundaries of the Empire tract (see Figure I.E-1). Samples were collected after approximately 0.4 inches of precipitation during a total precipitation event of approximately 0 7 inches over 24 hours. The data represent the expected quality of water entering the Empire tract. These samples were analyzed for conventional parameters as well as select metals, including chromium, lead, and zinc. A summary of the data is presented in Table I.E-3 as well as the relevant surface water criteria for FW2 streams in New Jersey (FW2 criteria are used since the samples are considered freshwater with salinities less than 3.5 ppt). For some parameters, including turbidity, TSS, fecal coliform, and lead, concentrations exceeded the criteria at least one location. Total coliform measurements were less than the HMDC discharge limit, suggesting an improvement in this parameter from conditions in 1984. Elevated detections of chemical oxygen demand (COD) rather than BOD suggests industrial discharges rather than sanitary discharges. Dissolved oxygen concentrations were well above the required minimum concentration of 4 mg/L, suggesting an improvement in DO compared to the HMDC 1978 to 1988 data and the ERM/GES 1984 data. These measurements were made during a runoff event in the early spring and HMDC's Moonachie Creek data were collected during the summer.

Table I.E-2

Empire Tract Sediment Quality - Metals Concentrations (ERM/GES 1984 Data)

Parameter	Unit	NJDEP Soil Cleanup Criteria, Non-Residential	NOAA's Effects Range-Median	Bashes Creek - Downstream (Station B1)	Moonachie Creek - (All Stations: M1,M2,M3)	Muddabach Creek - Downstream (Station LM)
Cadmium	mg/kg	100	9	<0.5	<0.5-1.4	<0.5
Chromium	mg/kg	NA	145	65.3-768.0	30.5-160.0	14.3-17.2
Copper	mg/kg	600	390	18.7-66.6	11.0-60.8	2.9-7.4
Iron	%	NA	NA	2.06-4.92	0.76-6.76	0.67-2.18
Lead	mg/kg	600	110	21.8-129.0	20.2-124.0	<0.5-1.9
Mercury	mg/kg	270	1.3	<0.1-1.4	0.2-0.7	<0.1
Nickel	mg/kg	2,400	50	21.8-47.8	9.1-40.5	3.8-7.4
Zinc	mg/kg	1,500	270	70.4-165	67.3-227.0	12.4-21.2

Notes: 1. NA=Not Available
2. Sediment core depths: 0-2 inches and 6-8 inches

Source: Data from ERM/GES 1984, NJDEP Soil Criteria from NJAC 7:26D 1996 (Proposed), NOAA's ER-M values from Long and Morgan, 1990 (Table 70)

Table I.E-3

Water Quality of Drainage into the Empire Tract (TAMS 1996 Data)

Parameter	Unit	NJ Surface Water Criteria (FW2)	Concentration in Moonachie Creek-Upstream of Site (Station 1)	Range of Concentrations in Outfalls/Ditches (Stations 2-5)
pH	–	6.5-8.5	7.2	6.5-7.2
Conductivity	µmho/cm	–	205	100-210
Turbidity	NTU	50	119	6-56
DO	mg/L	4.0 (min)	11.4	9.4-14.4
Fecal Coliform	#/100mL	200	100	32-756
Total Coliform	#/100mL	5,000 [1]	430	320-2,600
BOD	mg/L	25 [1]	<3	<3
COD	mg/L	–	57	19-59
Ammonia-Nitrogen	mg/L	–	<0.05	<0.05-0.068
Total Suspended Solids	mg/L	40	56	13-59
Chromium	µg/L	160	7.8(B)	3.4(B)-61.4
Lead	µg/L	5	37.0	9.6-22.6
Zinc	µg/L	--	106	<3.3-13.6(B)

Notes: 1.HMDC discharge limitation from ERM/GES 1985; NJ surface water standard not established
2. B=estimated concentration (inorganics)
Source: TAMS 1996 and NJAC 7:9B-1.14.

Off-Site Studies

As stated earlier, since the Empire tract is largely hydraulically isolated from the Hackensack River, water quality conditions in the river generally do not significantly impact conditions on site, except in circumstances when tide gates are malfunctioning and/or perimeter berms are overtopped or breached. A brief discussion of river water quality is provided below since the proposed brackish mitigation would reintroduce river water to a portion of the Empire tract.

Numerous water quality studies have been conducted in the Hackensack River near the Empire tract and in off-site tributaries. Some of the off-site studies are documented in the following reports or data packages:

- Bergen County Utilities Authority (BCUA) Impact Analysis of Sewage Treatment Plant (STP) Discharges on the Water Quality of the Lower Hackensack River, Volumes 1, 2, and 3; Clinton Bogert Associates (CBA) and Najarian Associates, September 1990;

- Comprehensive Baseline Studies IR-2 Site and Off-Site Mitigation Areas, Evaluation of Harmon Meadow Western Brackish Marsh Area; prepared for Hartz Mountain Industries, Inc. by TAMS Consultants, Inc. January 1990;

- The Hackensack Meadowlands Development Commission (HMDC) Water Quality Testing Program, Eleven Year Summary: 1978-1988; 1991;

- The Hackensack Meadowlands Development Commission Water Quality Testing Program, 1993-1997; HMDC, 1995, 1996, 1997; and

- Draft Environmental Impact Statement (DEIS) on the Special Area Management Plan (SAMP) for the HMD. June 1995. USEPA and USACE.

According to the SAMP DEIS (USEPA and USACE, 1995) for the HMD and the BCUA study, the lower Hackensack River estuary is not well-flushed as a result of reductions in freshwater inflows caused by the Oradell Reservoir and indirect connection with the open sea. Sources of pollutants include industrial discharges, combined sewer overflows (CSOs), emergency overflows, and landfills. In addition, power plant thermal discharges have historically impacted water quality. Newark Bay is also a source of pollutants to the lower river. These hydrologic and physical conditions and sources of pollutants have caused an impairment in water quality. The SAMP DEIS provided a summary of the results of the BCUA water quality model, which was based on data collected in 1988 and 1989. Relevant items of concern include:

- Low DO and high pollutant concentrations were detected during the summer months of the BCUA study. The two largest causes of DO depletion in the reach of the river (near the Empire tract) were the discharges from the BCUA STP and Public Service

Electric & Gas's (PSE&G) thermal discharge from Bergen Generating Station in Ridgefield. The BCUA STP was a source of oxygen-demanding compounds (BOD) and the power plant's thermal discharge increased the rate of oxygen consumption by microorganisms;

- According to the BCUA analysis (CBA/Najarian, 1990), the DO standard would be violated 21 percent of the time in the river should increased treatment of the BCUA discharge not be provided and the thermal discharge not be eliminated. Eliminating the PSE&G discharge would result in violations of the DO standard only 13.8 percent of the time. Eliminating the thermal discharge and increasing the level of treatment at the BCUA plant would result in violations only 6.8 percent of the time. According to a recent conversation with HMDC, the thermal discharge to the Hackensack River plant no longer exists (Lazor, September 22, 1997). Also, a portion of BCUA's treated wastewater is now pumped to the PSE&G facility for use as non-contact cooling water;

- Nearly 70 percent of the total pollutant load into the lower Hackensack River originates from Newark Bay, which is transported upstream on flood tide; and

- The marshes in the HMD act as a net source of DO to the Hackensack River system, resulting from primary productivity on the marsh surface and increased aeration from water movement through emergent vegetation (USEPA/ USACE, 1995).

The HMDC and the US Geological Survey (USGS) have continued to monitor water quality conditions in the HMD from 1993 to the present. Two of the 14 stations are located in the Hackensack River near the Empire tract (see Figure I.E-1). HMDC's Station 2 is located near the northern end of the Empire tract at the NJ Turnpike bridge downstream of the BCUA Sewage Treatment Plant in Little Ferry, and Station 3 is near the southern end of the site near Bashes Creek. Both of these stations are in the reach of the Hackensack River that is classified SE2 (NJAC 7:9B-1.15). HMDC (Konsevick, et al., 1994) documented results of the four seasonal sampling events conducted in 1993 and 1994. Average fecal coliform counts at the two river stations near the Empire tract exceeded the SE2 standard. This was likely caused by the BCUA STP and CSOs.

Average DO concentrations at these stations over the four sampling events (4.4 mg/L at Station 2 and 5.2 mg/L at Station 3) were greater than the minimum standard of 4 mg/L. However, summer (July 1993) concentrations of DO (1.9 mg/L at Station 2 and 2.3 mg/L at Station 3) were well below the minimum standard. The lower DO at Station 2 compared to Station 3 was likely caused by the proximity of the BCUA STP to Station 2. Average turbidity measurements exceeded the SE2 criterion at both stations. Concentrations of heavy metals in surface water at the two nearby stations were within the range of concentrations detected at all fourteen stations in the HMD.

A summary of the HMDC data from February 1995 through March 1997 for Stations 2 and 3 is provided in Table I.E-4. Salinities at the two rivers stations over this period indicate both fresh and

Table I.E-4

Water Quality - Hackensack River Concentrations (HMDC February 1995 - March 1997 Data)

Parameter	Unit	NJ Surface Water Criteria	Station 2 (Upstream)		Station 3 (Downstream)	
			Range	Average [1]	Range	Average [1]
pH	--	6.5-8.5	7.1-7.7	7.4 (9)	6.9-7.6	7.4 (9)
Salinity	ppt	>3.5 (SE2)	0.2-6.1	2.8 (9)	0.3-8.4	4.3 (9)
DO	mg/L	4.0 (min)	2.0-12.9	7.3 (9)	1.6-10.7	6.9 (9)
BOD	mg/L	--	1.1-10.4	5.6 (8)	2.1-29.8	7.9 (8)
COD	mg/L	--	15.6-123	55.6 (9)	20.9-176	77.3 (9)
TSS	mg/L	40	9.3-69	28.3 (9)	0.6-93.9	34.1 (9)
Turbidity	NTU	30 (SE2)	8-126	23 (9)	5-285	40 (9)
Fecal Coliform	#/100mL	770 (SE2)	20-9,000	1,480 (9) GM=320 [2]	<20-9,000	1,930 (9) GM=350 [2]
Ammonia	mg/L	--	0.5-6.8	3.8 (9)	1.8-5.6	4.0 (9)
Cadmium	µg/L	10 (FW2)	1.7-19.3	7.8 (9)	4.3-24.7	13.0 (9)
Chromium	µg/L	3,230 (SE2)	1.1-16.8	6.8 (9)	2.5-24.0	13.5 (9)
Lead	µg/L	5 (FW2)	19.5-175	74 (9)	34.6-250	89 (9)
Nickel	µg/L	3,900 (SE2)	10.6-222	70 (9)	15-256	103 (9)
Zinc	µg/L	--	18-174	53 (9)	19-180	64 (9)

Notes: 1. Numbers in parenthesis represent number of observations
2. GM=Geometric mean used for comparison to fecal coliform standard
3. FW2 standard provided for those parameters that do not have a SE2 standard
Source: Data from HMDC File "HR23WQ.XLS" dated May 22, 1997 transmitted to TAMS

brackish conditions at different times. Salinities were typically one to two ppt greater at the downstream station compared to the upstream station. Average DO concentrations at each station exceeded the minimum standard of 4.0 mg/L. However, two of the nine readings at the upstream station were less than 4 mg/L (2.0 and 2.8 mg/L) whereas only one of the nine readings at the downstream station was less than the 4.0 mg/L standard (1.6 mg/L). Average TSS concentrations were less than the standard.

The geometric mean of the fecal coliform counts at each station was less than the geometric mean-based standard. The average concentrations of the heavy metals during this period were either less than or within the range of concentrations detected at all fourteen stations in the HMD as documented by Konsevick et al (1994).

2.0 Tidal Gaging at the Project Site

Within the study area, the Hackensack River is an estuary, a semi-enclosed coastal body of water with free connection to the ocean and subjected to its tides. Tides, the movement of water above and below mean sea level, play a major role in the hydraulic functioning of the estuary. The Hackensack River's tidal prism has been estimated at 13,800 MGD (million gallons/day). This is relatively large compared to the estimated average freshwater inflow of 340 MGD, resulting in a generally well-mixed (both vertically and longitudinally) estuary (BCUA, 1990). The mean astronomic tidal range within the river near the site is approximately five ft, with a mean low-water elevation at -1.5 ft NGVD and a mean high-water elevation at 3.5 ft NGVD. The mean spring high-water elevation is about 3.8 ft NGVD (TAMS, 1990).

3.0 Tidal Flow Rates

The flood insurance study (FIS) was utilized to approximate the amount of fluvial flow (riverine, non-tidal freshwater flow) in the Hackensack River adjacent to the subject property. The following discussion of existing peak flow rates in the Hackensack River and the Empire tract drainage areas is presented to illustrate how small the Empire tract drainage area is when compared to the Hackensack River drainage area. The Hackensack River stations near Losen Slote include (FEMA, 1995).

- Confluence with Overpeck Creek
  Hackensack River Drainage Area = 134.4 sq mi
  Location - 8,600 ft north of Losen Slote
  100 - Year Flow - 7,519 cfs

- Confluence with Bellman's Creek
  Hackensack River Drainage Area = 154.4 sq mi
  Location - 5,800 ft south of Losen Slote
  100 - Year Flow - 10,710 cfs

Therefore, the flow at the Hackensack River/Losen Slote confluence as estimated by straight-line interpolation (FEMA, 1995) is 9,421 cfs.

For existing conditions in the Empire tract drainage area, the 100-year peak fluvial flow rate has been calculated to be approximately 130 cfs. This was calculated by summing the attenuated discharges at the Moonachie Creek and Muddabach Creek tide gates, utilizing XP-SWMM dynamic hydraulic modeling software. This peak flow is approximately 1.4 percent of the estimated 100-year Hackensack River flow near Losen Slote.

4.0 Marsh Effectiveness

If the site was hydraulically isolated from the river and was effectively functioning as a wetland, whereby vegetative areas would continuously interact with surface waters, it would be expected that concentrations of many of the parameters at the downstream stations would be consistently less than concentrations at the upstream and midstream stations. A review of the data summarized in Subchapter I.E.1 indicates that there was no consistent improvement in water quality in a downstream direction through the site. Rather, concentrations of many of the water quality parameters were greater at the downstream stations (and the river station) when compared to the upstream stations as a result of the leaking tide gates. In fact, a review of the existing data does not suggest that the existing wetland system serves to improve the water quality of drainage through the site.

Biochemical oxygen demand (BOD) concentrations at the downstream Moonachie Creek station were consistently greater than the upstream and midstream Moonachie Creek stations (Table I.E-1) which could suggest that the site was a source of BOD between the upstream and downstream stations. However, when comparing the concentrations at the downstream stations on Moonachie Creek (M1) and Muddabach Creek (LM) to the river station (HR), it is also likely that the river was a source of BOD to the site during this time through the malfunctioning tide gates. The river was also a likely source of chemical oxygen demand (COD) to the site. COD concentrations consistently increased in a downstream direction in Moonachie Creek from Station M3 to Station M1. Bashes Creek and Muddabach Creek concentrations were similar to concentrations in the river station.

The data for dissolved oxygen (DO) (Table I.E-1) could suggest that the site was a source of DO to the river in that concentrations at the downstream Moonachie Creek station (M1) were generally greater than river concentrations. However, it should be noted that the station in the Hackensack River was located near the mouth of Muddabach Creek and not Moonachie Creek. The river station (HR) was more than one mile upstream of the mouth of Moonachie Creek along the Hackensack River River water was not sampled near the mouth of Moonachie Creek or Bashes Creek. It has been shown that DO concentrations in the river, near the mouth of Muddabach Creek, have been less than concentrations farther downstream in the river near Moonachie Creek (see DO profiles in the BCUA report, Clinton Bogert and Najarian, 1990) as a result of discharges from the BCUA sewage treatment plant and thermal discharges from a power plant, both upstream of Muddabach Creek.

Therefore, it is possible that river DO concentrations near the mouth of Moonachie Creek would have been greater than concentrations recorded at Station HR near Muddabach Creek. Thus, the possible conclusion that the site is a source of DO to the river based on a comparison of data from the Moonachie Creek stations to data from Station HR is likely not valid. For example, when comparing results from Muddabach Creek (LM) to the river station near Muddabach Creek (HR), DO concentrations on site were roughly equal to concentrations in the adjacent river station. Thus, the site would not be considered a source of DO to the river in this area.

Similar to many of the other water quality parameters, phosphorus concentrations at the Muddabach Creek station were similar to concentrations at the river station as a result of leaking tide gates (Table I.E-1). Concentrations in Moonachie Creek generally increased in a downstream direction towards the river suggesting that the river is the major source of phosphorus to the site. Upstream stations were not observed to have elevated concentrations following rain events in early September and early October. Nitrogen concentrations at the river station were generally greater than concentrations at the on-site creek stations (Table I.E-1). A slight increase in nitrogen concentrations was observed in a downstream direction in Moonachie Creek suggesting that the river was also a source of nitrogen. Concentrations at the Muddabach Creek station were once again similar to concentrations at the river station.

Cadmium, copper, lead, and nickel were not detected in surface water samples collected during the 1984 investigation. Mercury was only detected off-site in Losen Slote at a concentration (4 μg/L) near the detection limit (1 μg/L). Chromium, iron, and zinc were detected in surface water samples collected on site in 1984 and results (Table I.E-2). Chromium was detected at the Moonachie Creek midstream station (M2) in ten of the twelve samples collected during this investigation. Chromium was not detected at the downstream Moonachie Creek station (M1) in each of the twelve samples, nor in the other downstream samples and river samples. This would suggest possible dilution by river water or possible adsorption to suspended matter in the water column and subsequent settling to the sediment during transport. Total iron was detected at greater concentrations at the upstream and midstream Moonachie Creek stations when compared to the downstream and river stations. Once again, concentrations at the Muddabach Creek station (LM) were similar to concentrations at the river station For zinc, with the exception of the October 30 river sample, concentrations at the Muddabach Creek station and each of the on-site stations were similar to the concentrations at the river station and were all less than 0.1 mg/L.

The ineffectiveness of the existing wetlands at improving water quality is attributed to the physical isolation of the site and the hydroperiod of the on-site *Phragmites* wetlands. Because the Empire tract is currently isolated from daily tidal inundation by man-made berms and tide gates, the majority of the site is a *Phragmites* wetland that is not subject to tidal wetland hydraulics. The tide gates prevent river water intrusion during rising tides, and allow upstream surface water flows to be discharged when the Hackensack River is at or near low tide. The berms and tide gates prevent daily tidal inundation and also help to decrease the frequency of inundation of the upstream areas during tidal storm surge events. As the site is not subject to regular tidal inundation and the ground surface elevation within the *Phragmites* stands is too high to be inundated by stormwater runoff, except

during large storm events, the prevailing hydroperiod over the majority (an estimated 95 percent) of the site is saturated.

5.0 Benthic Sampling

Benthos are organisms (invertebrates, fish and vegetation) that inhabit the benthic (i.e., bottom) region of a water body. This discussion of the benthos at the Empire tract concerns benthic invertebrates, as the on-site creeks are unvegetated, marsh surface invertebrates are discussed in Section I.C.3, and fish are discussed in Section I.D.3. Benthic invertebrates are defined as those invertebrate animals that spend at least a portion of their life cycles within or upon the bottom of a water body.

Section I.E.5.1 discusses the results of a benthic survey conducted by TAMS in 1997 at each of the creeks located within the Empire tract, and Section I.E.5.2 presents data on the benthic invertebrates within the Hackensack River adjacent to the site.

5.1 Empire Tract

Benthic invertebrate samples were collected by TAMS in April 1997 to provide current data on the species composition and abundance of benthic invertebrate communities at the Empire tract. Due to their limited mobility and relatively long life spans, benthic invertebrates are typically used as indicators of changing environmental conditions (Weber, 1973).

Benthic samples were collected at a total of 15 stations along Moonachie Creek (MC), Muddabach Creek (MUDD), and Bashes Creek (BC) within the Empire tract. The approximate sample locations are shown in Figure I.D-1. Quantitative samples were collected using an Ekman grab sampler. Three replicate benthic samples were collected per station for a total of 45 samples. The samples were washed and processed in the field and subsequently analyzed in the laboratory.

A total of six benthic taxa were collected from creeks at the Empire tract:

- Aquatic earthworm (Oligochaeta);
- Midge larvae (Chironominae);
- Biting midge larvae (Ceratopgonidae);
- Scud (Amphipoda);
- Pouch snail (*Physella* sp.); and
- Dragonfly larvae (Libellulidae).

Table I.E-5 presents the number of individuals (expressed as number per sq m) of each taxa collected at the 15 stations. The dominant benthic organism collected at each station was the oligochaete worm (commonly referred to as sludge worm). Densities ranged from a low of 797 worms per sq m at Moonachie Creek Stations 5 and 6 to a high of 6,131 worms per sq m at Muddabach Creek Station 3. Midge larvae were encountered at all but two stations, but at a much lower density. The other four taxa were observed infrequently, as can be seen in Table I.E-1.

5.2 Hackensack River

To assess the species composition and abundance of benthic invertebrates within the Hackensack River adjacent to the Empire tract, an aquatic inventory conducted by the HMDC (1989) was reviewed. The inventory, which was conducted throughout the HMD from 1987 through 1988, featured two Hackensack River sampling stations, referred to as Trap Net 5 (TN 5) and Seine 4 (S4), adjacent to the Empire tract. Trap Net 5 was located on the western bank of the river near the mouth of Losen Slote, while S4 was located on the western bank of the river just below the New Jersey Turnpike Western Spur. Six benthic macroinvertebrate taxa were collected from the two Hackensack River stations. These data are presented in Table I.E-6. In general, the benthic invertebrate community structures were similar between the Empire tract and the Hackensack River, although there were a greater abundance of oligochaetes on the Empire tract.

Table I.E-5

Benthic Invertebrates on the Empire Tract
(expressed as number per square meter)

Sampling Station	Oligochaete Worm	Midge larvae	Biting midge larvae	Amphipod	Pouch snail	Dragonfly larvae
BC 1	826	145	–	–	–	–
BC 2	2,739	14	–	–	–	–
BC 3	1,116	39	–	–	–	–
BC 4	3,362	29	–	58	–	–
MUDD 1	1,942	333	–	–	–	–
MUDD 2	1,754	449	–	–	–	–
MUDD 3	6,131	39	29	–	–	–
MUDD 4	1,812	14	–	–	–	–
MC 1	2,826	14	–	–	–	–
MC 4	1,812	–	–	–	–	–
MC 5	797	29	–	–	–	29
MC 6	797	39	29	–	–	–
MC 7	1,608	14	–	–	275	14
MC 8	2,072	–	–	–	126	–
MC 9	1,319	29	–	14	–	–

Notes: BC = Bashes Creek; MUDD = Muddabach Creek; MC = Moonachie Creek; "–" indicates organism not observed at station
Source: Field collection by TAMS staff in April 1997

Table I.E.6

Benthic Invertebrates in Hackensack River Adjacent to Empire Tract

Common Name	Scientific Name	TN 5 (average per sq m)	S4 (average per sq m)
Aquatic earthworm	Oligochaeta	262	196
Hydrobid snail	*Hydrobia totteni*	63	162
Midge larvae	Chironomidae	25	44
Biting midge larvae	*Chaoborus*	2	2
Platform mussel	*Congeria leucopheata*	0	7
Water mite	Hydracarina	0	2
Source: HMDC, 1989.			

F. EXISTING LAND USES AND RATABLE VALUES

Text to be provided at a later date

G. DEMOGRAPHICS

Text to be provided at a later date

1.0 Bergen County

1.1 Population and Household Size
1.2 Income and Income Distribution
1.3 Employment

2.0 Borough of Carlstadt

2.1 Population and Household Size
2.2 Income and Income Distribution
2.3 Employment

H. PUBLIC SERVICES

1.0 Sanitary Sewers

The site lies entirely within the Bergen County Utilities Authority (BCUA) service area. The BCUA wastewater treatment plant (New Jersey Pollutant Discharge Elimination System [NJPDES] Permit No. NJ0020028) is located less than one mile northeast of the site, in the township of Little Ferry.

The BCUA planning area has a year 2010 estimated population of 550,000 people, as per the Northeast New Jersey Water Quality Management Plan.

The BCUA wastewater treatment plant currently (1997) treats approximately 70 to 80 million gallons per day (MGD) of sewage flow. It is noted that a recent treatment plant expansion has been completed, and the plant now has an upgraded physical capacity of 109 MGD. For the year 2010, the estimate of anticipated average daily flow is 85 MGD, which includes an allowance of 23 MGD for infiltration/inflow (I/I).

Sewerage infrastructure exists to potentially convey sewage from the Meadowlands Mills project. A connection point for sewage discharge has been identified in the immediate vicinity, just prior to the existing Carlstadt Sewerage Authority's (CSA) Barell Avenue Sewage Pumping Station located at the southeast end of Barell Ave. The pump station has been designed to accommodate additional pumps that may be required to convey the Meadowlands Mills sewage flow rates. The pump station discharges through an 18-inch force main into the BCUA 48-inch trunk sewer, known as the Hasbrouck Heights extension, beneath Empire Boulevard.

The Empire tract is currently undeveloped; therefore, no wastewater is generated on-site. The CSA's buried 18-inch force main is located within a 15-foot easement in the northern section of the project site.

2.0 Potable Water Supply

There is a potable water supply system, maintained and operated by United Water New Jersey (formally known as the Hackensack Water Company), serving the area surrounding the project site. The source water is conveyed from four large impoundment reservoirs in northern New Jersey and southern New York state. The Oradell Reservoir, located in the borough of Haworth, is the primary source of water to the system. Oradell Reservoir water is treated by a water treatment plant located on its eastern shore. Currently the nearest potable water supply well which contributes to the United Water New Jersey system is located in Upper Saddle River, New Jersey, more than 15 miles to the north.

The project area is served via 20 inch and 12 inch water distribution mains located beneath Washington Avenue. In addition, there are 12 inch mains beneath many of the surrounding roads, including Empire Boulevard, Commerce Boulevard, and Meadow Lane.

Likely connection points for the project in the immediate vicinity have been identified by United Water New Jersey as follows (Federico, March 18, 1997):

- 12 inch and 8 inch watermains beneath Paterson Plank Road;
- 12 inch watermain beneath Michelle Court;
- 8 inch watermain beneath Jomike Court; and
- 12 inch watermain beneath Barrel Avenue.

Results from the most recent pressure test in the vicinity of the aforementioned connections indicated that the water pressures in the Empire tract range from 95 to 98 pounds per square inch (psi) (Federico, April 18, 1997).

The Empire tract is currently undeveloped; therefore, there are no on-site potable water supply distribution mains or facilities.

3.0 Energy Supply

The energy requirements, including both electricity and natural gas, for the project area are currently supplied by the Public Service Electric and Gas (PSE&G) Company.

Electrical power to the area of the site is supplied via PSE&G's major substations in Ridgefield and East Rutherford. Transmission lines are located at Washington Avenue, Paterson Plank Road west of the NJ Turnpike, and beneath Empire Boulevard and Meadow Lane. Natural gas is supplied to the area of the site by an existing network of gas mains.

4.0 Solid Waste

The methods of collection and disposal of solid waste generated in the area are subject to state-mandated guidelines. Pursuant to these guidelines, the borough of Carlstadt has adopted a recycling ordinance which requires newsprint, high grade paper, mixed paper, glass, beverage containers, aluminum cans, ferrous scrap, leaves, white goods, tin cans, corrugated cardboard, grass, and construction and demolition debris to be recycled.

Regarding waste disposal, recent court rulings allow the generator to choose amongst the public and private sectors for a permitted disposal option. As an example, the BCUA owns and operates a transfer station/baler facility with a permitted capacity of 3,750 tons of solid waste per day.

The Empire tract is currently undeveloped; therefore, no solid waste is generated on-site.

5.0 County and Local Services

5.1 Police

The Borough of Carlstadt Police Department Headquarters are located in the Municipal Building at 500 Madison Street. The 26-man force is made up of the following:

- 1 Chief
- 1 Captain
- 2 Lieutenants
- 5 Sergeants
- 17 Patrolmen

There is approximately one police officer for every 210 borough of Carlstadt residents. In addition, there are three civilian dispatchers and six special police officers who are employed by the Department. A total of 12 vehicles are provided to the police force for patrol and other uses. County roads are also patrolled by the Bergen County Police Department, which can be called upon for assistance in emergencies.

In 1996, the borough of Carlstadt's total expenditure for municipal functions was over $8.9 million, of which more than 25 percent, or almost $2.3 million, was allocated for police protection. The 1997 budget increased expenditures on police protection to $2.34 million, or 28 percent of the total municipal budget of $8.2 million.

In 1995, there were a total of 324 crimes reported to the police in Carlstadt. Of these, 313 were considered non-violent and eleven were violent crimes. The number and categories of the non-violent crimes consisted of 201 cases of larceny, 67 motor vehicle thefts, and 45 burglaries. The violent crimes consisted of nine aggravated assaults and two robberies. In the one-year period between 1994 and 1995, the number of violent crimes declined 21.4 percent. In 1994, there were a total of 14 violent crimes and 285 non-violent crime cases reported within the borough. (Source: The New Jersey Department of State Police.)

5.2 Fire Protection

The Carlstadt Fire Department is manned by an 83-member team consisting entirely of volunteers. The fire department works out of two fire stations. The main fire station, with five bays, is located on the lower floor of the municipal building and has access to Jefferson Street. A new aerial platform truck is housed at the main fire station, along with two engines, a snorkel, a heavy rescue truck, and a rescue boat. The other firehouse, a two-bay facility, is located on Washington Avenue, just south of Veterans Boulevard. One engine and the reserve pumper are stationed there. The fire department is dispatched by the Carlstadt Police Department.

The Carlstadt Fire Department also belongs to the South Bergen Mutual Aid Group, which is called upon when additional personnel and equipment are needed in a fire emergency. The Mutual Aid Group is comprised of 16 municipal fire departments and more than 60 pieces of fire-fighting equipment. In the 1993 municipal budget, almost $328,000, or 4.4 percent of the $7.4 million allocated for municipal functions, was assigned for fire protection.

5.3 Emergency Medical Services

The Carlstadt Volunteer Ambulance Corps is located at 424 Hackensack Avenue. A total of 23 active volunteers man the two ambulance vehicles stationed at this two-bay facility. A three-person crew is assigned to each rig. Each crew is assigned to a 12-hour shift, which changes at 6:30 am and 6:30 pm.

5.4 Health Services

There are no hospitals located within the borough. The hospital most often used in emergencies by the Ambulance Corps is the Hackensack University Medical Center, located at 30 Prospect Avenue, Hackensack, approximately four miles north of the Ambulance Corps building. This medical center is the major acute-care facility in the area, providing 614 beds. In 1996, the Emergency/Trauma Department treated 50,155 patients.

The second most-used hospital by the Ambulance Corps in emergency situations is the Meadowlands Hospital Center, located on Meadowlands Parkway in Secaucus. This 230-bed facility is located about five miles east of the Ambulance Corps building. The Corps also uses Passaic General Hospital, located about five miles to the west in the city of Passaic.

Text to be provided at a later date.

5.5 Carlstadt Municipal Budget

5.6 Bergen County Budget

I. AIR QUALITY

1.0 Existing and Historical Air Monitoring Data

1.1 National Ambient Air Quality Standards

The US Environmental Protection Agency (USEPA), under the requirements of the 1970 Clean Air Act (CAA) as amended in 1977 and 1990, has established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50). These are: carbon monoxide, nitrogen dioxide, ozone, particulate matter, lead, and sulfur dioxide.

- **Carbon monoxide (CO)** is a colorless, odorless gas. Carbon monoxide is the most commonly-occurring air pollutant. The major source of CO is the incomplete combustion of fuels used to power vehicles, heat buildings, process raw materials; the burning of refuse is another source. Carbon monoxide is a site-specific pollutant; major concentrations are found near the source, such as at heavily- congested intersections. The health effect associated with CO-contaminated air is reduced transport of oxygen by the bloodstream, a consequence of CO displacing oxygen in hemoglobin. Exposures to very high levels of CO are lethal and exposures to high levels for a short duration can cause headaches, drowsiness, or loss of equilibrium.

- **Nitrogen dioxide (NO_2)** is a yellowish-brown, highly reactive gas that is present in urban environments. The major source of nitric oxide and nitrogen oxide emissions is fuel combustion in boilers associated with electric utilities and industrial facilities. Nitric oxides oxidize in the atmosphere to form nitrogen dioxide. Nitrogen oxides cause irritation to the lungs, bronchitis, and pneumonia, and lowered resistance to respiratory infections.

- **Ozone (O_3)** is a photochemical oxidant and a major constituent of smog. Hydrocarbons and nitrogen oxides are precursor pollutants to the formation of ozone. Hydrocarbons and nitrogen oxides react in the presence of sunlight to form ozone. This reaction is time-dependent and usually takes place far downwind from the site where the contaminants were originally emitted. Thus, hydrocarbons and nitrogen oxides are reactive contaminants whose impact generally occurs well beyond the areas immediate to the source. High concentrations of ozone are a major health and environmental concern. For example, ozone is a principal cause of lung and eye irritation in urban environments.

- **Particulate matter** in an urban environment typically occurs as a result of incomplete fuel combustion. Particulate matter includes dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, and fires. Diesel fuel contributes more particulates to the atmosphere than does gasoline. An inhalable particulate is defined as a particulate

that is less than ten microns (PM10) in diameter. The major health effect caused by the inhalation of PM10 is damage to the respiratory organs.

- **Lead (Pb)** is a bluish-gray metal, usually found in small quantities within the earth's crust. The most significant contributors of lead emissions to the atmosphere are gasoline additives, iron and steel production, and alkyl lead manufacturing. Other sources of lead include combustion of solid waste, windblown dust from weathering of lead-based paint, and cigarette smoke. The use of lead-free gasoline has considerably reduced lead levels in the urban environment. Exposure to lead is dangerous for the fetus and results in pre-term birth. Other health effects are decreased intelligence quotient (IQ) for infants and small children, increased blood pressure in middle-aged men, and brain and kidney damage in adults and children.

- **Sulfur dioxide (SO_2)** is emitted into the atmosphere from the combustion of sulfur-bearing fuels for space heating and motor vehicles. The use of low sulfur fuels for space heating has reduced the amount of sulfur dioxide emitted from these sources. The combustion of gasoline and diesel fuels in motor vehicles accounts for a very small percentage of the total sulfur dioxides emitted. Respiratory illness and damage to the respiratory tract are the health effects associated with inhalation of sulfur dioxide emissions.

The NAAQS include primary and secondary standards. The primary standards were established at levels to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air. These standards are presented in Table I.I-1.

The CAA requires that the USEPA review scientific data every five years to ensure that the NAAQS effectively protect the public health. The USEPA has recently enacted a more stringent standard for ozone, which became effective on September 16, 1997. The final standard has been updated from 0.12 parts per million (ppm) of ozone measured over one hour to a standard of 0.08 ppm measured over eight hours, with the average fourth-highest concentration over a three-year period determining whether an area is in compliance. Following the promulgation of this revised NAAQS, the CAA provides up to three years for state governors to recommend and the USEPA to designate areas according to their most recent air quality data. In addition, states will have up to three years from designation to develop and submit State Implementation Plans (SIPs) to provide for attainment of the new standard. Therefore, the project's impact on the new ozone standard cannot be determined until these preliminary steps are completed by the state and federal governments..

Table I.I-1

National and New Jersey Air Quality Standards

Pollutant and Averaging Time	Primary Standard[1]	Secondary Standard[1]
Carbon Monoxide		
8-Hour Maximum	9 ppm[2]	9 ppm
1-Hour Maximum	35 ppm[2]	35 ppm
Nitrogen Dioxide		
Annual Arithmetic Mean	100	100
Ozone		
1-Hour Maximum	0.12 ppm[3]	0.12 ppm[3]
8-Hour Maximum	0.08 ppm[4]	0.08 ppm[4]
Particulate Matter[8]		
PM10		
Annual Arithmetic Mean	50	50
24-Hour Maximum	150[5]	150
PM2 5		
Annual Arithmetic Mean	15	15
24-Hour Maximum	65[6]	65
Lead		
Quarterly Arithmetic Mean	1.5[7]	1.5[7]
Sulfur Dioxide		
Annual Arithmetic Mean	80	—
24-Hour Maximum	365[1]	—
3-Hour Maximum	—	1300[2]

Notes.
1. All concentrations in micrograms per cubic meter of air ($\mu g/m^3$) or, except where noted, in parts per million (ppm).
2. Not to be exceeded during any calendar year.
3. Expected number of exceedences shall not be more than once per year (3-year average).
4 Standard attained when 3-year ave. of annual 4th-highest daily maximum 8-hour concentration is below 0.08 ppm.
5 Standard attained when annual highest 99th percentile of 24-hour concentrations over 3 years is below 150 $\mu g/m^3$.
6. Standard attained when the annual highest 99th percentile of 24-hour concentration over 3 years is below 65 $\mu g/m^3$.
7. The quarterly lead standard is not to be exceeded during any calendar quarter.
8. PM10 - particulate matter diameter of 10 microns or less; PM2.5 - particulate matter diameter of 2.5 microns or less.

Sources: 40 CFR 50; USEPA Fact Sheets, July 1997.

Additionally, a new standard for particulate matter was issued on July 18, 1997 by the USEPA. The standard for PM10 remains essentially unchanged, while a new standard for fine particles (PM2.5: diameter ≤ 2.5 micrometers) is set at an annual limit of 15 micrograms per cubic meter ($\mu g/m^3$), with a 24-hour limit of 65 $\mu g/m^3$. Because this new standard would regulate fine particulates for the first time, the USEPA will allow five years to build a nationwide monitoring network and to collect and analyze the data needed to designate areas and develop implementation plans. Therefore, this standard cannot yet be implemented until the necessary preliminary steps are undertaken by the state and federal governments.

1.2 Background Air Quality Data

The existing background ambient air quality of the study area can be characterized based on monitoring data collected by the NJDEP. Criteria pollutant concentration data are collected at several monitoring locations throughout the state of New Jersey. These data are compiled, analyzed, and summarized annually.

The maximum levels monitored during 1996 at the monitoring locations closest to the Empire tract are presented in Table I.I-2 and are considered representative for conditions at the project site based on similar type and intensity of land uses. The ambient air levels measured were well below the corresponding ambient air quality standards, except for ozone, which was below but close to the standard. This ozone level is expected since the region where the Empire tract and the ozone monitoring site are located has been designated as a nonattainment area for ozone.

1.3 State Implementation Plan

Areas that meet the NAAQS standard for a criteria pollutant are designated as being in "attainment;" areas where a criteria pollutant level exceeds the NAAQS are designated as being in "nonattainment." Nonattainment areas are subcategorized based on the severity of their pollution problem (marginal, moderate, serious, severe, and extreme for ozone and moderate and serious for PM10 and CO). When insufficient data exists to determine an area's attainment status, it is designated unclassifiable (or attainment).

The proposed project would be located in Bergen County, New Jersey, an area currently designated as moderate nonattainment for carbon monoxide and severe nonattainment for ozone, but classified as attainment with respect to all the other criteria pollutants. Reducing ozone levels would require the reductions of its two precursors, volatile organic compounds (VOCs) and NO_x. These pollutants form ozone through a series of complex atmospheric reactions.

The CAA as amended in 1990 mandates that state agencies adopt SIPs that target the elimination or reduction of the severity and number of violations of the NAAQS. SIPs set forth plans to achieve

Table I.I-2

Background Ambient Air Data

Pollutant	Averaging Period	1996 Data	NAAQS		Monitoring Location
			Primary	Secondary	
PM10[1]	Annual Mean	43	50	50	3401 Tonnele Avenue, North Bergen, Hudson County
	24-hr Second High	83	150	150	
Lead	Quarterly Mean	0.1	1.5	1.5	Avenue C & Wright St., Newark, Essex County
SO_2	Annual Mean	21	80	None	St. Charles & Berlin St., Newark, Essex County
	24-hr Second High	76	365	None	
	3-hr Second High	138	None	1300	
NO_2	Annual Mean	70	100	100	St. Charles & Berlin St., Newark, Essex County
O_3	1-hr Second High	225	235	235	St. Charles & Berlin St., Newark, Essex County
CO	8-hr Second High	6.7 ppm	9 ppm	9 ppm	3401 Tonnele Avenue, North Bergen, Hudson County
	1-hr Second High	11.0 ppm	35 ppm	35 ppm	

Notes: [1] Concentrations in $\mu g/m^3$
Source: *1996 Air Quality Report*, NJDEP Bureau of Air Monitoring, August 1997.

and maintain attainment of the NAAQS. The SIP applicable to this nonattainment area is the *State Implementation Plan (SIP) Revision for the Attainment and Maintenance of the Ozone National Ambient Air Quality Standards, Meeting the Requirements of the Alternative Ozone Attainment Demonstration Policy, Phase I Ozone SIP Submittal,* (NJDEP, December 31, 1996).

The SIP demonstrated that target emissions levels could be met by implementing specific control measures to obtain major reductions in emissions of ozone precursors emitted from stationary and mobile sources. The SIP set forth how emissions that contribute to the formation of ozone would be reduced by 15 percent from 1990 to 1996 and then by three percent per year until the area reaches attainment of the NAAQS. This project is located in the New York/Northern New Jersey/Long Island Air Quality Control Region, and the 1999 projected and target emission levels for the New Jersey portion of this area are presented in Table I.I-3.

This SIP was disapproved by the USEPA on December 12, 1997, because the emission control measures proposed in the SIP had not been fully implemented. Therefore, the state is currently developing measures to conform the SIP in order to 1) demonstrate the implementation of SIP proposed emission control measures for the future and 2) make up for emissions reductions that were proposed in this disapproved SIP that were not implemented.

Table I.I-3

1999 Projected Emission Inventories

Pollutant	Projected Level (tons per day)
VOCs	892
NOx	979
CO	2,778
Source: New Jersey SIP (December, 1996)	

1.4 Mobile Sources

Carbon monoxide is a site-specific pollutant. Major concentrations are found near mobile sources, specifically, at heavily congested intersections. The CO microscale air quality analysis is based on procedures outlined in the NJDEP document "Air Quality Analysis for Intersections" (AQAI) (NJDEP, November 1996). These procedures have been approved by USEPA and the Federal Highway Administration (FHWA).

Mathematical Models Used

Carbon monoxide traffic impacts are determined in two steps: 1) vehicle exhaust emission factors are calculated using the USEPA Mobile5a_h computer model; and 2) these emission factors are subsequently used as input for the USEPA CAL3QHC dispersion model to calculate CO concentrations. The models used are described as follows:

- Mobile5a_h generates vehicular emission factors based on locality-specific vehicle fleet characteristics including vehicle age, operating mode of vehicles (hot/cold starts), and percentage of oxygenated fuel used. Additionally, Mobile5a_h can incorporate adopted emission control strategies such as anti-tampering programs and inspection and maintenance (I/M) programs including stringency, compliance rate, waiver rate, and vehicle years covered.

- CAL3QHC (Version 2) predicts the level of CO or other pollutant concentrations from motor vehicles traveling near roadway intersections. The model incorporates inputs such as roadway geometry, traffic volumes, vehicular emission rates, and meteorological conditions.

CO Impact Assessment

The worst case CO impacts were estimated for receptor locations at four intersections (Figure I.I-1, Air Modeling Locations). Based on a Highway Capacity Manual (HCM) analysis performed for approximately ten signalized intersections in the project neighborhood, these four signalized intersections would experience the maximum changes in future traffic patterns due to the project or would operate with the overall worst case traffic conditions. Furthermore, only the pm peak period was modeled, because it was determined that this time period would represent the worst case operating conditions. The receptors were placed at reasonable locations along roadway edges such as sidewalks.

Locality specific composite emission factors provided by NJDEP were used. These composite emission factors were generated using Mobile5a_h. Idle emission factors were determined from the Mobile5a_h output in accordance with USEPA guidance (USEPA, 1993).

Air Modeling Locations

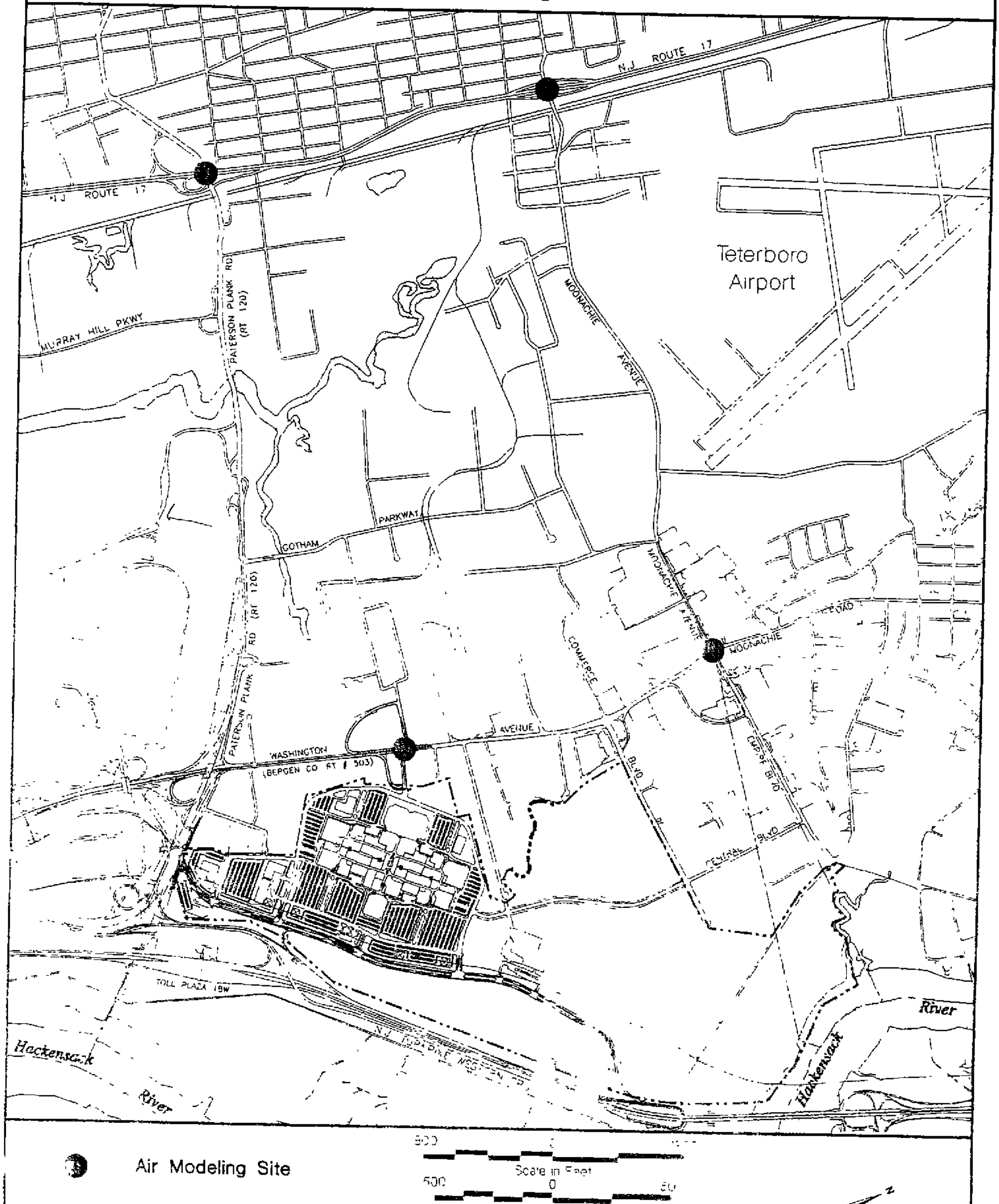


Figure II-1

The microscale CO analysis was performed using CAL3QHC (Version 2). The model incorporated the composite emission factors, current traffic volumes and intersection phasing data, and worst case meteorological conditions in order to determine the maximum air quality impact of the existing roadway conditions.

Background Concentration

Total ambient CO concentrations near intersections consist of two components: local source contributions (i.e., vehicular emissions near intersections) and background contribution from other sources, such as stationary sources, in the project area. Since no recorded background CO data are available for the Empire tract (CO data provided in Table I.I-2 include levels from both local sources and other sources), the default one-hour CO background level of 3.0 ppm and eight-hour level of 2.1 ppm, recommended by NJDEP for microscale CO impact analysis at intersections, were employed. These background levels are applicable to an intersection located in a suburban area.

Persistence Factor

A persistence factor of 0.7 was used to convert the one-hour CO concentrations (calculated by CAL3QHC) to eight-hour concentrations. The persistence factor represents a combination of the variability in both traffic and meteorological conditions, and is based on AQAI recommendations (NJDEP, 1996).

Results

The predicted worst-case CO impacts are presented in Table I.I-4. The worst-case conditions occur during the pm peak, with its worst-case traffic scenario. The modeling results indicate that no existing violations of the one-hour CO standard of 35 ppm and eight-hour CO standard of 9 ppm were predicted at the selected local intersections in the project area.

2.0 Project Area AAQS Attainment/Non-Attainment Status

Clean Air Act Conformity

The Clean Air Act Amendments (CAAA) of 1990 expand the scope and content of the CAA's conformity provisions by providing a more specific definition of conformity. As stipulated in CAAA Section 176(c), conformity is defined as "conformity to the State Implementation Program's (SIP) purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards." Conformity further requires that such activities will not:

(1) Cause or contribute to any new violations of any standards in any area;

Table I.I-4

Predicted Existing Worst-Case Carbon Monoxide Levels

Intersection Location	One-Hour CO Level (ppm)	Eight-Hour CO Level (ppm)	Receptor	Wind Angle	Dominant Traffic Link
Washington Ave/ Moonachie Ave/Empire Blvd	7.1	5.0	Mid-block, NE corner of Empire Blvd	250	WB approach
Washington Ave/ Jomike Court/Veterans Blvd	7.0	4.9	NW corner of Veterans Blvd & Washington Ave	165	SB approach
Paterson Plank Road (Rd)/ Route (Rte) 17 NB Ramp	6.9	4.8	Mid-block, NE corner of Paterson Plank Rd	215	WB approach
Moonachie Ave/ Rte 17 Southbound and Northbound Ramps	9.6	6.7	Mid-block, NE corner of Moonachie and Rte 17 NB on-ramp	240	NB off-ramp

Note: CO levels include background concentrations of 3.0 ppm (one-hour) and 2.1 ppm (eight-hour).

(2) Increase the frequency or severity of any existing violation of any standards in any area; or

(3) Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

Transportation Conformity

The USEPA published final rules on transportation conformity that apply to the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) approved or funded highway and transit projects in areas designated nonattainment or maintenance for any of the criteria pollutants under the CAA (40 CFR Parts 51 and 93) in the November 24, 1993 *Federal Register* (revised on August 15, 1997). The proposed rules require metropolitan planning organizations (MPOs) and the United States Department of Transportation (DOT) to make conformity determination on metropolitan transportation improvement programs (TIPs) before they are adopted, approved, or accepted. In addition, highway or transit projects which are funded or approved by the FHWA or FTA must be found to conform before they are approved or funded by DOT or an MPO.

The proposed project would involve roadway improvements. However, these improvements would be:

- Mainly limited to Empire tract internal access roadways with the Route 120 Extension (a regional roadway connecting to the New Jersey Turnpike); and

- Totally privately-funded by The Mills Corporation and classified as a non-federal project.

Approval for these roadway improvements would be required from the New Jersey Turnpike Authority (NJTA) and the Hackensack Meadowlands Development Commission (HMDC). Intersection signalization at four intersections within or near the Empire tract boundary would require approval from the New Jersey Department of Transportation (NJDOT). The NJTA and HMDC are not recipients of FHWA or FTA funding, therefore, transportation conformity rules do not apply to the NJTA and HMDC.

The NJDOT is a recipient of FHWA funding, however, it would only be responsible for approval of signalization at four intersections. According to the transportation conformity rules (CFR 40 Section 93.127), intersection signalization projects are exempt from regional emissions analyses. Furthermore, based on a discussion with the NJDOT Office of Major Access Permit (Catanese, April 2, 1998), approval of a signalization project proposed by a private developer is determined mainly based on: 1) intersection progression and signal spacing criteria that would address both safety and clean air concerns, and 2) potential traffic impact on progression at other adjacent intersections (but not based on the transportation conformity rule). Therefore, no specific clean air act transportation conformity determination is required for NJDOT to approve individual intersection signalization projects.

General Conformity

The USEPA published final rules on general conformity that apply to federal actions in areas designated nonattainment or maintenance for any of the criteria pollutants under the CAA (40 CFR Parts 51 and 93) in the November 30, 1993 *Federal Register*. The proposed rules provide specific *de minimis* emission levels by pollutant to determine the applicability of general conformity requirements for a proposed project. What this means from a regulatory perspective is that an analysis of project-related construction and operational period emissions is conducted to see if the de minimis emission levels are exceeded. If levels are determined to be below de minimis, no further analyses are necessary and a Record of Non-Applicability (RONA) is prepared. If de minimis levels are exceeded, a more detailed general conformity analysis is required. A general conformity determination is also required if emissions from a project are determined to be regionally significant. Under the general conformity regulations, regionally significant emissions are defined as emissions that equal at least 10 percent of the total nonattainment area emissions.

Since ozone is principally formed from NO_x and VOCs through a series of complex chemical reactions in the atmosphere, for the nonattainment area where the project is located, the following de minimis criteria would apply.

- 25 tons per year of volatile organic compounds (VOCs) or NO_x for a severe ozone nonattainment area;
- 100 tons per year of CO for a moderate CO nonattainment area.

Based on the general conformity rule, any direct and indirect emissions resulting from the proposed federal action and over which the USACE has continuing program responsibility within nonattainment areas must be included in the general conformity applicability analysis. The emission sources include area, mobile, and stationary sources as well as construction activities.

The proposed action is a private development project and the USACE's federal action is limited to permitting for wetlands fill and mitigation activities. Thus, the calculation of emissions for the general conformity applicability determination is also limited to wetlands fill and mitigation activities based on the regulations at 40 CFR Parts 6, 51, and 93: Determining Conformity of General Federal Actions to State or Federal Implementation Plans, Final Rule (USEPA, November 30, 1993). The final rule states:

> *"Where a USACE permit is needed to fill a wetland so that a shopping center can be built on the fill, generally speaking, the USACE could not practicably maintain control over and would not have a continuing program responsibility to control indirect emissions from subsequent construction, operation, or use of that shopping center. Therefore, only those emissions from the equipment and motor vehicles used in the filling operation, support equipment, and emissions from movement of the fill material itself would be included in the analysis."*

Additional pertinent guidance is provided in a general conformity directive issued by the USACE in 1994. The directive provides clear and emphatic guidance that indirect emissions that occur as a result of USACE permit actions, but which the USACE could not practicably control, should be excluded from conformity determinations for USACE permit actions (USACE, April 20, 1994).

For conformity purposes, the SIP applicable to the nonattainment area where the project would be located is the *State Implementation Plan (SIP) Revision for the Attainment and Maintenance of the Ozone National Ambient Air Quality Standards, Meeting the Requirements of the Alternative Ozone Attainment Demonstration Policy, Phase I Ozone SIP Submittal,* (NJDEP, December 31, 1996). This SIP provided the projected emissions levels for CO, VOCs, and NO_x in the region for 1999.

3.0 Regional and On-Site Meteorological Conditions

Based on historical meteorological data collected at Newark International Airport, regional winds are predominantly from the southwest during most of the year, with an average annual wind speed of ten miles per hour (mph). However, during winter months the wind shifts, coming from the northeast to northwest. Average winter temperatures range from mid-twenties to upper thirties, while the average summer temperatures range from low seventies to low eighties.

Based on meteorological data during the 1991 short-term monitoring program obtained from the Teterboro Airport located approximately 1.5 miles from the project site, the average wind speed was 8.4 mph, the wind direction was from the southwest, and the average ambient temperature was 52° Fahrenheit.

J. NOISE

1.0 Existing and Historical Noise Monitoring Data

A noise measurement survey was conducted in the study area. Noise monitoring receptor selection was based on the location's noise sensitivity, such as a residential or open-space site. All receptors were adjacent to streets with potential increases in traffic attributable to the proposed project. Of particular concern are those residences located on the nearby perimeter roads of the project area.

Ten monitoring locations were selected to provide representative measures of the existing noise levels (Figure I.J-1, Noise Monitoring Locations). A weekday sampling measurement program was conducted on April 14, 15, 29, and 30, May 9 and 14, June 24, and July 8 at Sites 1 through 11 during the am (7-9 am) and pm (5-7 pm) time periods. Noise measurements were taken five ft from the existing building walls. The receptor microphone height was eight ft above ground level.

- Site 1 - A commercial area on Washington Avenue near the intersection of Commerce Boulevard. The receptor is located approximately 70 ft from the centerline of Washington Avenue on the west side of the road almost at the intersection of Commerce Boulevard. Washington Avenue is a four-lane road with two lanes in each direction and no street parking.

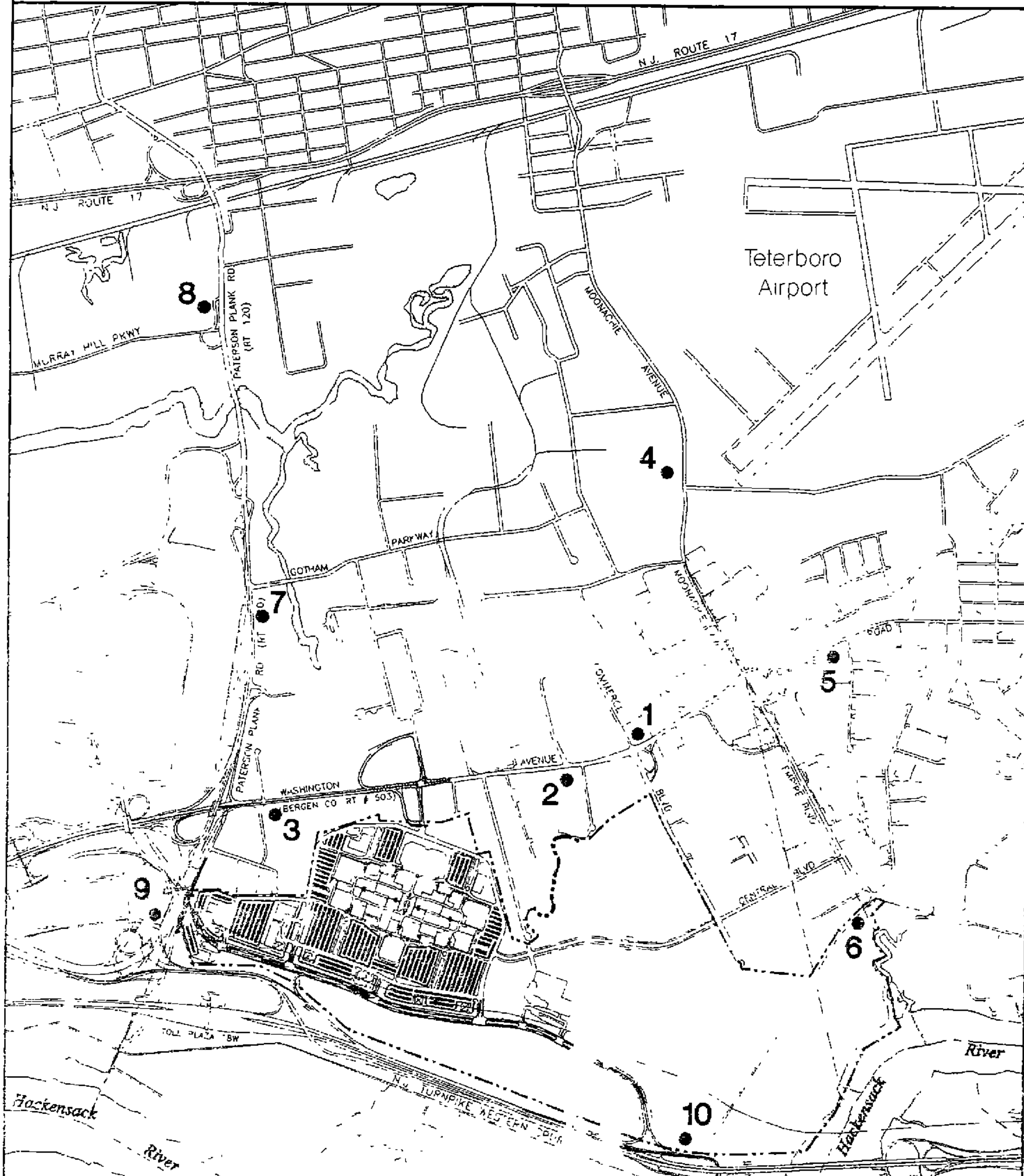
- Site 2 - A mix of residences and commercial establishments on Washington Avenue between Commerce Boulevard and Barell Avenue. The receptor is located at 217 Washington Avenue, a single family residence on the east side of Washington Avenue. The receptor is located approximately 50 ft from the centerline of Washington Avenue.

- Site 3 - A commercial area on Washington Avenue between Barell Avenue and Paterson Plank Road. The receptor is located at Econolodge Motel on the east side of Washington Avenue, and approximately 60 ft from the center of Washington Avenue. The receptor microphone was located in the parking lot in front of some windows facing Washington Avenue.

- Site 4 - A residential area, Rogers Trailer Park, on Moonachie Avenue between Washington Avenue and Route 17. The area is across from Teterboro Airport. The receptor is located at the closest residence, which is approximately 50 ft from the centerline of Moonachie Avenue. Moonachie Avenue is a two-lane road with one lane in each direction and an airport turning lane. There is no on-street parking.

- Site 5 - A residential neighborhood with single-family homes and churches on Moonachie Road between Empire Boulevard and Carol Place. The receptor was located at 232 Moonachie Road on the west side of the street approximately 70 ft

Noise Monitoring Locations



● 1 Noise Monitoring Site

Scale in Feet

Scale in Meters

Figure ... 1

from the centerline of the roadway. Moonachie Road is a two-lane road with one lane of traffic in each direction and no on-street parking.

- Site 6 - A commercial area near at the end of Empire Boulevard between Washington Avenue and State Street. The receptor is located on Empire Boulevard where it intersects State Street at the northern end of the project property line. The receptor is adjacent to the Bergen County Utility Authority property and is near the New Jersey Turnpike.

- Site 7 - A commercial area on Paterson Plank Road between Washington Avenue and Murray Hill Parkway. The receptor is located at The Hampton Inn Hotel on the north side of Paterson Plank Road just east of Gotham Parkway. The receptor is approximately 100 ft from the centerline of Paterson Plank Road. Paterson Plank Road is a four-lane road with two lanes in each direction and no on-street parking.

- Site 8 - A commercial area on Paterson Plank Road between Murray Hill Road and Route 17. The receptor is located at The Fairfield Inn Hotel on the south side of Paterson Plank Road just west of Murray Hill Road. The receptor was located in a parking lot approximately 100 ft from the centerline of Paterson Plank Road.

- Site 9 - A commercial area consisting of restaurants and recreational facilities on Paterson Plank Road east of Washington Avenue. The receptor is located on Paterson Plank Road adjacent to the Continental Arena, with a direct line of sight to the NJ Turnpike. Paterson Plank Road is a four-lane road with two lanes of traffic in each direction and no on-street parking.

- Site 10 - There are currently no residential or commercial land uses for the area surrounding the receptor located on the project's eastern boundary adjacent to the NJ Turnpike.

Measurements at each sampling location were made on the A-scale (dBA) for a sampling period of 30 minutes. A wind screen was used to minimize wind noise across the face of the microphone. The data was digitally recorded by the noise analyzer and displayed at the end of the measurement period.

Existing Noise Levels

The one-hour equivalent noise levels (one-hour L_{eq}) measured at Sites 1 through 10 are presented in Table I.J-1. The predominant source of noise at all the receptor locations is vehicular traffic. Aircraft noise is not significant in relation to the monitored traffic noise. Given the existing level of vehicular traffic, the measured noise levels are common for commercial/residential mixed land uses. While not directly applicable, the FHWA noise criteria provide a useful yardstick by which to assess the existing noise environment in the study area. The FHWA criterion for Activity Category B land uses (residential, parkland, hospitals, etc.) is 67 dBA. Existing noise levels exceed the 67 dBA criterion

Table I.J-1

Existing Sound Levels - Sites 1 through 10

Site	Land Uses	Noise L_{eq} (1-hour) Levels (dBA)	
		7-9 AM	5-7 PM
1	Commercial	76	75
2	Residential	77	76
3	Commercial	75	74
4	Residential	70	72
5	Residential	66	68
6	Commercial	61	60
7	Commercial	73	75
8	Commercial	73	74
9	Commercial	70	73
10	Vacant land	74	76

at all residential sites except Site 5 during the am peak hours. The FHWA criterion for Activity Category C land uses (commercial lands, etc.) is 72 dBA. Existing noise levels exceed 72 dBA criterion at all commercial sites except Sites 6 and 9 during the am peak hours.

The analytical tool used to predict noise levels from mobile sources is the FHWA Highway Traffic Noise Prediction Model STAMINA 2.0. In order to best approximate on-site conditions that affect the propagation of vehicle generated noise, the STAMINA model was first used to model the existing noise levels at the same 10 representative locations described above. After a series of adjustments are made to more accurately reflect various site-specific parameters and factors such as topographic conditions, roadway geometry, and roadway profile, the model is considered calibrated when the corresponding predicted noise levels and monitoring levels are within three dBA. A three-dBA difference represents a barely perceptible change in noise levels. The model can then be used to determine future noise levels.

Since typical traffic conditions occurred when noise monitoring was conducted, the traffic volumes obtained during the traffic data collection program were used in noise modeling. Based on the traffic conditions during both am and pm peak hours, pm peak traffic conditions were considered the worst-case conditions and were used for model calibration. The modeling results are presented in Table I J-2 Existing monitored and calculated noise levels are within three dBA; thus the STAMINA model is considered an accurate tool to predict mobile source noise levels for the project.

2.0 Noise Regulations and Guidelines

Noise Fundamentals and Methodology

Noise pollution comes from many sources. Some noise is caused by activities associated with the health, safety, and welfare of the community's inhabitants, including emergency vehicle sirens, garbage collection operations, and construction and maintenance equipment operations. Other sources of noise such as traffic and aircraft stem from the movement of people and goods, activities that are essential to the viability of a community as a place to live and do business.

Ways to Measure Noise

A number of factors affect sound as it is perceived by the human ear. These include the actual level of the sound (or noise), the frequencies involved, the period of exposure to the noise, and changes or fluctuations in the noise levels during exposure. Levels of noise are measured in units called decibels (dB). Since the human ear cannot equally perceive all pitches or frequencies, these measures are adjusted or weighted to compensate for the human lack of sensitivity to low-pitched and high-pitched sounds. This adjusted unit is known as the A-weighted decibel, or dBA. The A-weighted network de-emphasizes both very low- and very high-pitched sound so that the measured levels correlate well with the human perception of loudness.

Table I.J-2

STAMINA Model Calibration

Site	Monitoring Levels (dBA)	Modeled Levels (dBA)	Modeled Levels - Monitoring Levels
1	75	74.4	-0.6
2	76	73.3	-2.7
3	74	72.9	-1.1
4	72	69.4	-2.6
5	68	67.7	-0.3
6	60	61.8	1.8
7	75	73.4	-1.6
8	74	73.8	-0.2
9	73	70.7	-2.3
10	76	76.5	0.5

Human response to changes in noise levels depends on a number of factors, including the quality of the sound, the magnitude of the changes, the time of day at which the changes take place, whether the noise is continuous or intermittent, and the individual's ability to perceive the changes. Human ability to perceive changes in noise levels varies widely with the individual, as does response to the perceived changes. Generally, changes in noise levels less than 3 dBA will be barely perceptible to most listeners, whereas a 10 dBA change is normally perceived as a doubling (or halving) of noise levels. These guidelines permit direct estimation of an individual's probable perception of noise level changes.

Since the dBA noise metric describes a noise level at just one moment, and very few noises are constant, other ways of describing noise over extended time periods are needed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific time period as if it had been a steady, unchanging sound. For this condition, a descriptor called the equivalent sound level, L_{eq}, can be computed. The L_{eq} descriptor is the constant sound level that, in a given situation and time period (e g., one-hour L_{eq}, or 24-hour L_{eq}), conveys the same sound energy as the actual time-varying sound. Statistical sound level descriptors such as L_1, L_{10}, L_{50}, L_{90}, and L_x are also sometimes used to indicate noise levels which are exceeded 1, 10, 50, 90, and x percent of the time, respectively.

Alternatively, it is often useful to account for the different responses of people in residential areas to noises that occur during sleeping hours as compared to waking hours. A descriptor, the day-night noise level (L_{dn}), is defined as the A-weighted average sound level in decibels during a 24-hour period with a 10 dB weighting applied to nighttime sound levels. It is a widely-used indicator for such evaluations. The 10 dB weighting accounts for the fact that noises at night sound louder because usually fewer noises occur at night. The L_{dn} descriptor has been proposed by the US Department of Housing and Urban Development (USHUD), the US Environmental Protection Agency (USEPA), and other organizations as one of the most appropriate criteria for estimating the degree of nuisance or annoyance that increased noise levels would cause in residential neighborhoods.

The maximum one-hour equivalent sound level (one-hour L_{eq}) is the noise descriptor used in this noise impact analysis. Maximum one-hour equivalent sound levels provide an indication of the highest expected sound levels.

Noise Standards and Criteria

There are a number of standards and guidelines appropriate for assessing noise impacts in the context of an Environmental Impact Assessment. They are useful in that they provide both a characterization of the quality of the existing noise environment as well as a measure of project-induced impacts.

Federal Highway Administration (23 CFR 772)

Federal Highway Administration (FHWA) noise regulations require that a noise analysis be conducted for all highway projects (FHWA, 1974). Even though these regulations are not directly applicable

to the proposed project (which is not a highway project), they were used in this analysis since they are the principal federal government guidance for the evaluation of traffic-related noise impacts. These standards contain noise abatement criteria that the FHWA considers to be the acceptable limits for noise levels for exterior land uses and outdoor activities and for certain interior uses (Table I.J-3). The FHWA noise abatement criteria lists developed land use types as Categories A, B, C, or E. Category B, which includes residences, schools, and hotels and motels, would represent the most sensitive receptors that lie in proximity to the Empire tract. Future noise levels are predicted to evaluate the extent of impact in relation to the noise abatement criteria. If these criteria are exceeded, or if there is a substantial increase above the existing noise level, abatement or mitigation measures are considered. FHWA also provides noise sensitivity criteria (Table I.J-4) to evaluate the significance of any noise impacts.

Generally, a three dBA or smaller change in noise level would be barely perceptible to most listeners, whereas a ten dBA change is normally perceived as a doubling (or halving) of noise levels. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels; thus, a three-dBA increase was used in this study as the threshold for determining noise impact significance.

New Jersey State (NJAC 7: 29-1.2)

New Jersey state noise regulations require that noise levels resulting from industrial, commercial, public service, or community service facilities cannot exceed:

- 65 dBA during 7 am to 10 pm at residential property line;
- 50 dBA during 10 pm to 7 am at residential property line; and
- 65 dBA at the property line of other commercial facility.

These regulations apply to on-site noise sources associated with the future project development and do not apply to off-site motor vehicle noise.

Hackensack Meadowlands Development Commission

The HMDC has established noise performance standards for the HMD in *Hackensack Meadowlands Development, Subchapter 6: General Provisions*. These regulations apply to on-site stationary noise sources associated with projects developed within the HMD but not to traffic noise from roadways These noise performance standards include:

Table I.J-3

FHWA Noise Abatement Criteria

Activity Category	$L_{eq}(h)$	$L_{10}(h)$	Description of Activity Category
A	57 (exterior)	60 (exterior)	Land for which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	70 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (exterior)	75 (exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	—	—	Undeveloped lands.
E	52 (interior)	55 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Note: The L_{eq} and L_{10} designations represent hourly A-weighted sound levels expressed in decibels (dBA). Either $L_{10}(h)$ or $L_{eq}(h)$ (but not both) may be used on a project.

Source: US Department of Transportation, FHWA, 1974.

Table I.J-4

Decibel Changes and Loudness

Change (dBA)	Relative Loudness
0	Reference
3	Barely perceptible change
5	Readily perceptible change
10	Half or twice as loud
20	1/4 or four times as loud
30	1/8 or eight times as loud

Source: Based on Highway Traffic Noise Analysis and Abatement - Policy and Guidance. (FHWA, June 1995.)

- Noise level should not exceed 55 dBA during 7 an to 9 pm and 45 dBA during 9 pm to 7 am in any residential zone, residential specially planned area, or residential planned unit development; and

- Impact noise is considered when noise peak level is more than six dBA higher than measured level.

K. TRANSPORTATION

1.0 Highways and Roads

The Empire tract is bordered by the New Jersey Turnpike's Western Spur to the east, Paterson Plank Road to the south, Washington Avenue to the west, and Empire Boulevard to the north. The Meadowlands Sports Complex and existing NJ Route 120 are located at the southwest corner of the Empire tract, a map of which is found in Figure I.K-1, Traffic Count Locations. Appendix D of this document is the Traffic Impact Study (Raymond Keyes Associates, 1997).

1.1 Description of Roadway Network

The following is a brief description of the roadways serving the development:

- NJ Turnpike Western Spur: The Western Spur of the NJ Turnpike is a major north/south interstate highway facility consisting of two to three lanes per direction. In the vicinity of the Empire tract, Interchanges 16W and 18W provide connections to NJ Route 3 and the Meadowlands Sports Complex roadway network. The NJ Turnpike's Western Spur has a posted speed limit of 55 mph and is under the jurisdiction of the New Jersey Turnpike Authority (NJTA).

- NJ Route 3: NJ Route 3 is a major limited-access, east/west state highway consisting of three to four lanes per direction. In the vicinity of the Empire tract, NJ Route 3 has major interchanges with NJ Route 17, NJ Route 120, and the NJ Turnpike's Western Spur. NJ Route 3 has a posted speed limit of 55 mph and is under the jurisdiction of the New Jersey Department of Transportation (NJDOT). Currently, NJDOT is constructing improvements along Route 3 to provide for an additional lane in each direction from Route 17 to the New Jersey Turnpike.

- NJ Route 17: NJ Route 17 is a north/south state highway. In the vicinity of the Empire tract, NJ Route 17 generally consists of three lanes per direction, with grade-separated interchanges provided at its crossings with Moonachie Avenue, Paterson Plank Road, and NJ Route 3. NJ Route 17 has a posted speed limit of 55 mph and is under the jurisdiction of the NJDOT.

- Paterson Plank Road (NJ Route 120): Paterson Plank Road is a divided, east/west arterial roadway connecting NJ Route 17 to the west with Washington Avenue to the east, and continuing to the Hackensack River. The section of Paterson Plank Road between Washington Avenue and NJ Route 17 is also referred to as NJ Route 120 and is under the jurisdiction of NJDOT. Paterson Plank Road consists of two lanes per direction and has a posted speed limit of 40 mph. The section of Paterson Plank Road east of Washington Avenue is a local roadway and consists of one lane per direction with a posted speed limit of 25 mph.

Traffic Count Locations

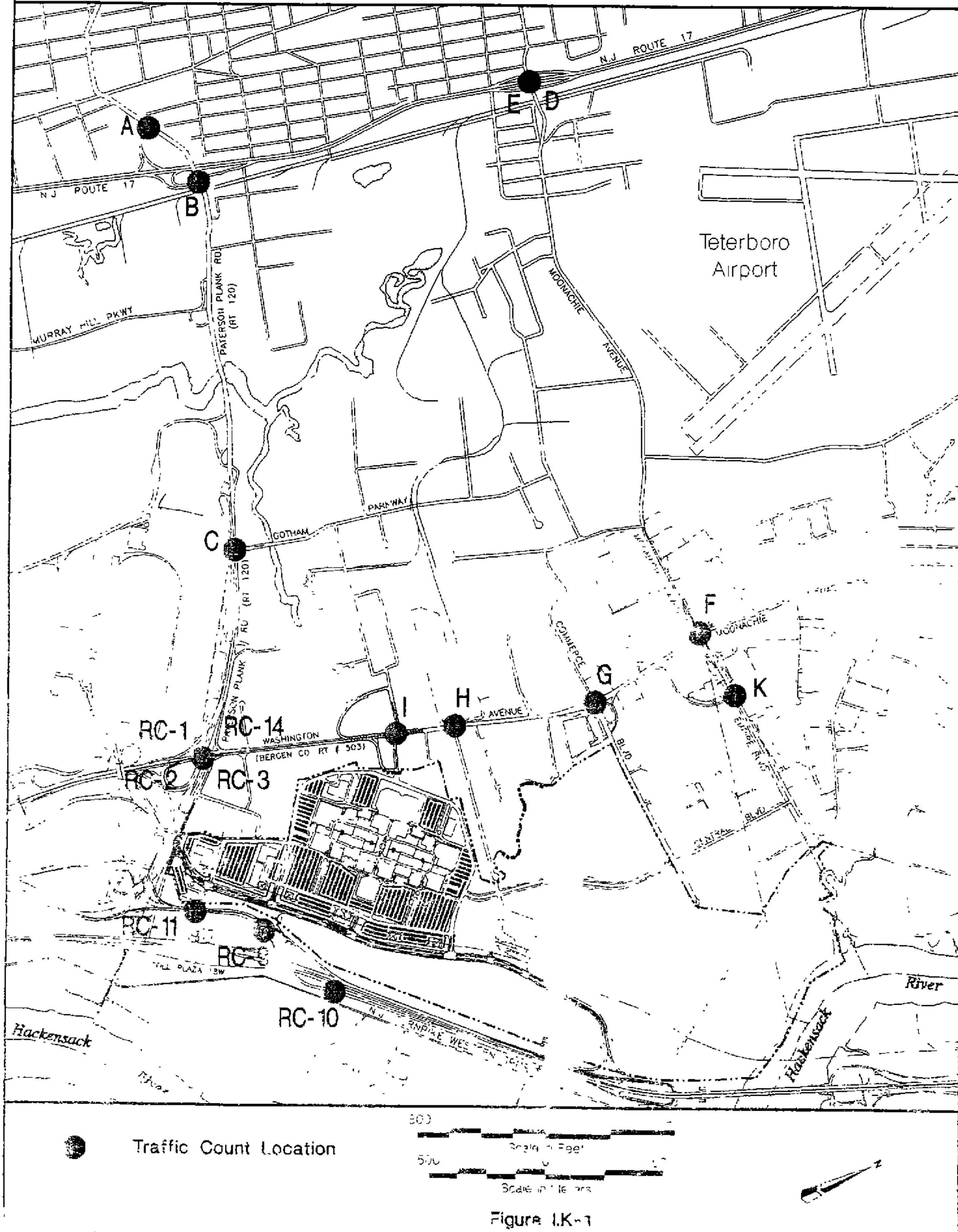


Figure I.K-1

- NJ Route 120: NJ Route 120 is a north/south limited-access state highway that consists of three lanes per direction between NJ Route 3 and Washington Avenue. NJ Route 120 has grade-separated interchanges with NJ Route 3, the Meadowlands Sports Complex, and Washington Avenue/Paterson Plank Road, where it continues to the west as Paterson Plank Road. NJ Route 120 is under the jurisdiction of NJDOT and has a posted speed limit of 50 mph. This roadway is currently under design by NJDOT for relocation to the east side of the Continental Arena.

- Washington Avenue (Bergen County Route 503): Washington Avenue is a north/south undivided (in most areas) arterial roadway connecting the township of Moonachie to the north with Paterson Plank Road and NJ Route 120 to the south. Washington Avenue consists of two lanes per direction and has a posted speed limit of 40 mph. Washington Avenue is under the jurisdiction of Bergen County.

- Moonachie Avenue: Moonachie Avenue is an east/west undivided arterial roadway connecting NJ Route 17 in the west with Washington Avenue in the east. Moonachie Avenue currently consists of one lane per direction with a center lane used for left turns. Moonachie Avenue is under the jurisdiction of Bergen County and has a posted speed limit of 30 to 40 mph.

1.2 Field Studies

Available data regarding existing roadway conditions, right-of-way, and planned improvements on the highway and roadway networks in the area surrounding the Empire tract were collected from the NJDOT, the NJ Turnpike Authority, New Jersey Transit, the Bergen County Department of Public Works, the Hackensack Meadowlands Development Commission (HMDC), and local municipalities. Information regarding seasonal variations of traffic volumes was obtained from NJDOT and the NJ Turnpike Authority through both discussions and review of data from their Automatic Traffic Recorder (ATR) counts.

Manual traffic counts were collected on Wednesday, June 18, 1996 from 4:00 pm to 8:00 pm at the following locations (See Appendix D):

- Locations A and B: NJ Route 120/Paterson Plank Road & NJ Route 17 Interchange;

- Location C: Intersection of Paterson Plank Road and Gotham Parkway;

- Locations D and E: Intersection of Moonachie Avenue with NJ Route 17 ramps;

- Location F: Intersection of Washington Avenue and Moonachie Avenue;

- Location G: Intersection of Washington Avenue and Commerce Boulevard;

- Location H: Intersection of Washington Avenue and Barell Avenue;
- Location I: Intersection of Washington Avenue and Jomike Court/Veterans Boulevard;
- Location K: Intersection of Empire Boulevard and Terminal Lane; and
- Location L: Intersection of New Boulevard and Paterson Plank Road.

The manual turning movement counts conducted on this day occurred during three events at the Meadowlands Sports Complex (racetrack events, a carnival, and a roller hockey game). This count was also supplemented by an evening count on June 19, 1996.

In addition, previous counts used as a base for the 1996 counts were conducted on June 22, 1991 and June 29, 1991. All of the traffic counts were collected on days when events were ongoing at the Meadowlands Sports Complex (see text box).

Traffic Counts Conducted During Meadowlands Sports Complex Events

Date	Event
Wednesday, June 18, 1996	Harness racing, carnival, and roller hockey
Thursday, June 19,1996	Harness racing, a concert, and a carnival
Saturday, June 22, 1991	Harness racing, flea market, and a carnival
Saturday, June 29, 1991	Harness racing, flea market, and a carnival

As reported by the Meadowlands Sports Complex, all events were "well attended;" for example, the harness racing events on June 18 and 19, both at 7:30 pm, had attendances of 5,741 and 6,114, respectively. Attendance figures for the concert and carnival were unavailable. However, the average attendance for the New Jersey Rockin' Rollers roller hockey exhibitions is above 5,000 persons per game, as reported by Roller Hockey International. Additionally, each event had a traffic flow that was representative of typical events. During these traffic counts, it should be noted that the access ramps to/from the northbound western spur of the New Jersey Turnpike were open to traffic.

Field inspections of the roadways in the vicinity of the Empire tract and data collected included roadway geometries, roadway channelization, roadside limitation, and traffic flow data. All count data utilized is contained in Appendix A of the Traffic Impact Study (Appendix D of this document) (Raymond Keyes Associates, 1997).

1.3 Key Study Locations and Descriptions

Based on discussions with the HMDC and a review of the development-generated traffic volumes, the following locations were determined to be key locations requiring detailed traffic analyses (Appendix D). Field surveys of the existing roadway network by representatives of Raymond Keyes Associates revealed the following conditions at the key locations. Locations are categorized as Signalized Intersection Locations, Unsignalized Intersection Locations, Ramp Capacity Locations, and Ramp Intersection Locations.

Signalized Intersection Locations

- Location B: Paterson Plank Road and NJ Route 17 Northbound ramps. Paterson Plank Road is the major east/west leg of this signalized intersection. The NJ Route 17 northbound off-ramp is the one-way northbound approach at this intersection. Paterson Plank Road has a posted speed limit of 40 mph at this location.

- Location C: Paterson Plank Road and Gotham Parkway. Paterson Plank Road is the major east/west approach of this signalized T-intersection. Gotham Parkway forms the minor southbound approach. Left turns are prohibited from eastbound Paterson Plank Road to Gotham Parkway. Paterson Plank Road has a posted speed limit of 40 mph.

- Location D: Moonachie Avenue and NJ Route 17 southbound ramps. Moonachie Avenue is the east/westbound approach at this signalized, diamond interchange. The southbound ramp from NJ Route 17 is a minor approach at this intersection. Traffic signals are in place at the ramp location and are coordinated to operate as one signal.

- Location E: Moonachie Avenue and NJ Route 17 northbound ramps. Moonachie Avenue is the east/westbound approach at this signalized, diamond interchange. The northbound ramp from NJ Route 17 is a minor approach at this intersection. Traffic signals are in place at both ramp locations and are coordinated to operate as one signal.

- Location F: Washington Avenue/Moonachie Road and Moonachie Avenue/Empire Boulevard. Washington Avenue is the northbound approach, Moonachie Road is the southbound approach, Moonachie Avenue forms the eastbound approach, and Empire Boulevard forms the westbound approach of this signalized, four-legged intersection. Northbound left turns from Washington Avenue are prohibited at this intersection and are processed through the Terminal Lane jughandle.

- Location G: Washington Avenue and Commerce Boulevard. Washington Avenue is the major north/south approach at this signalized, four-legged intersection and has

a posted speed limit of 40 mph. Commerce Boulevard is the minor east/west legs of this intersection.

- Location I: Washington Avenue and Veterans Boulevard/Jomike Court. Washington Avenue is the major north/south approaches of this offset signalized, four-legged intersection. Veterans Boulevard is the eastbound approach and is slightly offset from the westbound approach of Jomike Court. Washington Avenue has a posted speed limit of 40 mph at this location.

Unsignalized Intersection Locations

- Location A: Paterson Plank Road and Enoch Street. Paterson Plank Road is the major east/westbound approach at this unsignalized intersection. Enoch Street is the minor southbound approach of this T-intersection and operates under STOP sign control. Enoch Street serves local traffic as well as a significant amount of the NJ Route 17 southbound exiting traffic.

- Location H: Washington Avenue and Barell Avenue. Washington Avenue is the major north/south legs of this unsignalized T-intersection. Barell Avenue is the minor westbound approach of this full-movement intersection and operates under STOP sign control. Washington Avenue has a posted speed limit of 40 mph.

- Location K: Empire Boulevard and Terminal Lane. Empire Boulevard is the major east/west legs of this unsignalized T-intersection. Terminal Lane is the northbound minor approach of this intersection and is a one-way roadway acting as a jughandle from Washington Avenue. This intersection is controlled by YIELD signs on the minor approach of Terminal Lane and all approaches are signed for a speed limit of 25 mph.

Ramp Capacity Locations

- Locations RC1-RC3: Eastbound NJ Route 120/Paterson Plank Road/Washington Avenue ramps. RC-1 - Route 120 Eastbound Ramp to Meadowlands Sports Complex: This ramp is currently a two lane ramp allowing movement from Route 120 Eastbound (Paterson Plank Road) to Route 120 (Sports Authority). RC-2 - Route 120 Eastbound Ramp to Northbound Washington Avenue: This ramp is currently a one lane ramp allowing movement from Route 120 Eastbound (Paterson Plank Road) to Northbound Washington Avenue. RC-3 - Route 120 Westbound Ramp to Westbound Route 120: This ramp is currently a two lane ramp allowing movement from Westbound Route 120 (Meadowlands Sports Complex) to Westbound Route 120 (Paterson Plank Road).

- Location RC9-RC11: NJ Turnpike/Meadowlands Sports Complex ramps. RC-9 - Sports Authority to NJ Turnpike Southbound: This ramp currently exists as Ramp NWC. It allows exiting Meadowlands Sports Complex traffic to access the southbound NJ Turnpike. This ramp exists as a one-lane ramp. RC-10 - Meadowlands Sports Complex to NJ Turnpike northbound: This ramp allows exiting Meadowlands Sports Complex traffic to access the NJ Turnpike northbound. This ramp, NWC, exists as a one-lane ramp. RC-11 - Southbound NJ Turnpike to the Meadowlands Sports Complex: This ramp exists as a two-lane section connecting southbound NJ Turnpike into the Meadowlands Sports Complex.

- Location RC14: Southbound Washington Avenue/Route 120 westbound ramp. This ramp is currently a one lane ramp allowing movement from Southbound Washington Avenue to westbound Route 120 (Paterson Plank Road).

Ramp Intersection Locations

- Location RI-A: Eastbound Route 120/Southbound Washington Avenue ramp. This ramp is currently a two-lane ramp allowing movement from Route 120 eastbound (Paterson Plank Road) to Route 120 (Meadowlands Sports Complex). This ramp provides the diverge from Route 120 where Route 120 continues as one lane to connect with northbound Washington Avenue.

1.4 Traffic

Peak Hours

In analyzing the impact of the Meadowlands Mills development on the adjacent roadway network, it was necessary to determine those hours during which the development's traffic volumes would have the greatest impact on the surrounding roadways.

Through discussions with the HMDC, it was determined that the peak hours to be studied included a peak pm highway hour, and what can be termed the peak pm event hour. The peak pm event hour was chosen to examine the effects of Meadowlands Mills traffic in conjunction with a significant volume of Meadowlands Sports Complex traffic on area roadways. Traffic counts were performed on days when at least three events were occurring at the Meadowlands Sports Complex.

The majority of traffic that would be generated by the Meadowlands Mills development would be out of phase with the periods of greatest traffic activity at the Meadowlands Sports Complex (i.e., football games on Sundays). Traffic from Meadowlands Mills would have minimal impact on a Sunday, as the major components of Meadowlands Mills are office and retail. Office traffic is virtually non-existent on Sunday. In addition, traffic in the area is lessened due to local ordinances or "blue laws" which prohibit shopping in Bergen County on Sunday.

It was determined that the peak hours for study were as follows:

- Weekday peak pm highway hour: 4:45 to 5:45 pm; and
- Weekday peak pm event hour: 6:30 to 7:30 pm.

The weekday peak pm event hour was chosen over a peak Saturday event hour as the combined site-generated and existing volumes in the vicinity of the Empire tract are the highest during the peak pm event hour. The determination of peak hours was based on three concurrent evening events being held at the Meadowlands Sports Complex. Based upon Table I.K-1, the peak pm event hour volumes along Paterson Plank Road are 30 percent greater than those volumes calculated for the peak Saturday hour.

The peak am hour was not studied due to the assumed trip-generating characteristics of Meadowlands Mills during that hour. The office component would generate entering traffic during the peak am hour, with little traffic being generated by the retail and restaurant components. (Note that the hotel component would generally generate similar amount of traffic during all hours studied.) By comparison, Meadowlands Mills would generate traffic associated with exiting office traffic and entering and exiting retail and restaurant traffic during the peak pm highway hour.

Table I.K-1

Two-Way Volume on Paterson Plank Road

Volume Component	Peak PM Event Hour (6:30-7:30 PM)	Peak Saturday Hour (12:00-1:00 PM)
1991 Existing Volume	1739	1253
Proposed Retail	178	219
Proposed Office	28	26
Proposed Restaurant	18	20
Proposed Industrial	0	0
Proposed Hotel	59	37
TOTAL	2022	1555
Source: Raymond Keyes Associates, 1997		

The potential overall new traffic generated by the Meadowlands Mills during the peak am hour is approximately 35 percent less than the overall new traffic generated during the peak pm highway hour. However, to ensure that the peak pm highway hour volumes controlled the design, a sensitivity analysis was conducted at two critical locations. This sensitivity analysis is contained in Subchapter III.J.4 of this report, and confirms that the peak pm highway hour is the design hour.

The 1996 peak pm highway hour traffic volumes and the peak pm event hour traffic volumes utilized to determine roadway capacities are presented in Appendix D.

Traffic Operating Conditions

The existing 1996 traffic volumes were compared to roadway capacities to determine the 1996 existing traffic operating conditions. The capacity analyses that define these conditions are summarized in Table I.K-2 (Also see Appendix D).

Existing 1996 Analysis Summary

Based upon the foregoing analysis and results included in Table I.K-2, the area roadway network generally operates at acceptable Levels of Service (LOS). However, existing delays (LOS "F") are indicated at the unsignalized intersections of Paterson Plank Road and Enoch Street, Washington Avenue and Barell Avenue, and Empire Boulevard and Terminal Lane. These delay conditions are attributable to the existing minor street left-turn movements at these intersections. It is recognized that an improvement at these locations would consist of a traffic signal being introduced; however, it is only appropriate to introduce a traffic signal at various unsignalized locations when Signal Warrants (as contained in the Manual on Uniform Traffic Control Devices) are met. The locations with these delay conditions may not meet these Traffic Warrants; therefore, it is recommended that traffic signals be installed, when and if Signal Warrants are met. The projected theoretical delays at these locations may, in fact, be offset by adjacent signals that create gaps in the traffic stream, creating a platooning effect for which the theoretical analysis does not account for.

A LOS "F" overall delay exceeding 60 seconds is indicated for the signalized location at the intersection of Washington Avenue and Commerce Boulevard in the peak pm highway hour. This condition is a function of the existing signal timing. Since signal timing is usually monitored and updated by the jurisdictional municipality, it can be expected that the signal timing at this location would be updated periodically to accommodate the flow of traffic at that time. Optimization of signal timing would result in acceptable LOS.

Overall, all ramps would operate above capacity, thereby being acceptable for peak hour conditions.

Table I K-2

Traffic Operating Conditions
Level of Service Summary

Location		1996 Existing Overall Conditions	
		Peak PM Highway Hour LOS	Peak PM Event Hour LOS
A	Paterson Plank Rd & Enoch St	f(1) (124.9)	c (8.4)
B	Paterson Plank Rd & NJ Route 17 NB Ramps	A(2) (4.0)	B (5.5)
C	Paterson Plank Rd & Gotham Pkwy	B (10.5)	A (3.3)
D	Moonachie Ave. & NJ Route 17 SB Ramps	C (20.8)	C (23.0)
E	Moonachie Ave. & NJ Route 17 NB Ramps	E (42.9)	D (30.3)
F	Washington Ave. & Moonachie Ave	C (16.3)	B (9.3)
G	Washington Ave. & Commerce Rd.	F (*)	B (15.0)
H	Washington Ave. & Barell Ave.	f (67.3)	b (0.8)
I	Washington Ave & Veterans Blvd/Jomike Ct.	B (9.1)	B (7.2)

Table I.K-2, Continued

Traffic Operating Conditions
Level of Service Summary

Location		1996 Existing Overall Conditions	
		Peak PM Highway Hour LOS	Peak PM Event Hour LOS
K	Empire Blvd. & Terminal Lane	f (15.9)	b (2.6)
L	New Boulevard & Paterson Plank Rd.	N/A[(4)]	N/A
1	New Boulevard and Site Access No. 1	N/A	N/A
2	New Boulevard and Site Access No. 2	N/A	N/A
3	New Boulevard and Site Access No. 3	N/A	N/A
4	New Boulevard and Site Access No. 4	N/A	N/A
5	New Boulevard and Site Access No 5	N/A	N/A
6	New Boulevard and Site Access No. 6	N/A	N/A
7	New Boulevard and Site Access No. 7	N/A	N/A
RC1	Rt 120 EB ramp to Sports Authority	A[(3)] 12.6	A 6.8
RC2	Rt 120 EB ramp to Sports Authority	A 4.7	A 3 9

Table I.K-2, Continued

Traffic Operating Conditions
Level of Service Summary

Location		1996 Existing Overall Conditions	
		Peak PM Highway Hour LOS	Peak PM Event Hour LOS
RC3	SB Washington Ave to EB Rt 120	C 22.3	B 10.8
RC4	SB Rt 120 Extension to EB Rt 120	N/A	N/A
RC5	RC 3&4 to Rt 120 EB	N/A	N/A
RC6	Rt 120 EB to NJ Turnpike	N/A	N/A
RC7	RT 120 WB to Paterson Plank Rd	N/A	N/A
RC8	Rt 120 WB to NJ Turnpike	N/A	N/A
RC9	Sports Authority to NJ Turnpike SB	A 1.1	A 0.9
RC10	Sports Authority to NJ Turnpike NB	A 0.8	A 0.6
RC11	SB NJ Turnpike to Sports Authority	A 3.6	B 17.9
RC12	SB NJ Turnpike to Route 120 WB	N/A	N/A
RC13	WB Route 120 to Washington Ave NB	N/A	N/A

Table I.K-2, Continued

Traffic Operating Conditions
Level of Service Summary

Location		1996 Existing Overall Conditions	
		Peak PM Highway Hour LOS	Peak PM Event Hour LOS
RC14	SB Washington Ave to Route 120 WB	A 5.6	A 1.5
RC15	SB NJ Turnpike to Route 120 Extension	N/A	N/A
RC16	New Boulevard to NJ Turnpike SB	N/A	N/A
RC17	NJ Turnpike NB to Route 120 Extension	N/A	N/A
RI-A	Diverge from Route 120 EB to Sports Authority	N/A	N/A
RI-B	Diverge from Route 120 EB NJ Turnpike ramp to Paterson Plank Rd	N/A	N/A
W-A	Route 120 EB	N/A	N/A
W-B	Route 120 WB	N/A	N/A

Notes: 1 Unsignalized intersection (lower case), level of service (LOS), delay of critical movement in seconds per vehicles (sec).
2 Signalized intersection (upper case), LOS, delay in seconds per vehicle (sec).
3. Ramp Capacity (RC), LOS, density in passenger cars per mile per lane (pc/mi/ln).
4. N/A represents areas to be studied under future conditions only.

Source: Raymond Keyes Associates, 1997

1.5 New Jersey State Highway Access Management Code

The applicant was actively involved in the Route 120 Relocation Task Force, comprised of officials of the HMDC, NJDOT, Bergen County, the New Jersey Turnpike Authority, and other interested parties to determine the geometric issues and capacity constraints affecting the design of the NJ Route 120 Relocation project. Through this involvement and the fact that access to the Empire tract is largely developed from the Western Spur of the New Jersey Turnpike, it has been determined that the New Jersey State Highway Access Management Code is not applicable to this project. Furthermore, NJDOT has indicated (see letter from Russell Tong, Assistant Commissioner of NJDOT, in Appendix D) that the New Jersey State Highway Access Management Code is, indeed, not applicable to the Meadowlands Mills project.

In accordance with NJDOT design policy, Meadowlands Mills has requested "Authorization to Design" (from the regional branch of the NJDOT) five new traffic signals associated with the Meadowlands Mills project. These new traffic signals are as follows:

- Paterson Plank Road and the Route 120 Extension;
- Meadowlands Mills driveway and the Route 120 Extension;
- Meadowlands Mills driveway and the Route 120 Extension;
- Meadowlands Mills driveway and the Route 120 Extension; and
- Empire Boulevard and Terminal Lane.

As indicated in the letters from NJDOT contained in Appendix G, NJDOT has granted approval to proceed with the design of the first four traffic signals listed above. The fifth signal (intersection of Empire Boulevard and Terminal Lane) is not under NJDOT jurisdiction and approval lies with Bergen County (at the time of this writing a decision from Bergen County had not yet been rendered).

2.0 Public Transport

Currently, there are six public NJ Turnpike bus lines (Nos. 160, 161, 163, 164, 703, and 772) passing Meadowlands Mills that service the entire Meadowlands region, including both New Jersey and New York City commuting residents. Route 703 provides service between Haledon and East Rutherford, while the remaining routes provide local and express service between New Jersey communities and New York City. There is currently no train or rail service for the Meadowlands Mills area.

3.0 Other Modes of Transport

There are no other modes of transit that will have a significant effect on transportation aspects of the proposed Meadowlands Mills.

L. AESTHETICS

Currently the Empire tract is undeveloped and is best characterized as being topographically flat and largely covered by the common reed *(Phragmites australis)*. The Empire tract is bisected north-south by the New Jersey Turnpike's Western Spur. Views of the Empire tract from the turnpike are limited by the tall *Phragmites* that grows to heights of ten to twelve feet. *Phragmites* is regularly subject to wildfires that create blackened areas and have, on occasion, been known to close down the turnpike from their dense smoke. The only location on the turnpike that permits extensive views of the Empire tract is from the bridge that carries the turnpike over the Hackensack River, immediately north of the site.

To the west, the Empire tract abuts the eastern edge of existing commercial/industrial development in the borough of Carlstadt. This commercial/industrial development extends two miles west from the site to Route 17, that runs northeast-southwest at the foot of the ridge on which the residential section of Carlstadt is located. The commercial/industrial development has a ragged boundary with the Empire tract, "protruding" into the undeveloped area of the site at several locations east of Washington Avenue. These commercial/ industrial warehousing and manufacturing facilities are typically large single-story "boxes" built over the past three decades. There is very little architectural cohesion to the area other than its utilitarian nature.

Immediately to the southwest of the Empire tract are the facilities of the Meadowlands Sports Complex, with its visually dominant Giants Stadium, the Continental Airlines Arena, and the grandstands of the race track. These facilities are surrounded by extensive surface parking covering hundreds of acres. The other notable visual landmarks in the vicinity of the site are the twin Transco natural gas tanks, approximately 140 ft tall and of a similar diameter, located immediately to the east of the Empire tract between the turnpike and the Hackensack River. To the north and the east, portions of the property extend to the Hackensack River that flows north to south through the Hackensack Meadowlands District (HMD). As with the Empire tract, the adjacent undeveloped areas are predominantly vegetated by common reed (Figure I.L-1, Aerial View of Site from North).

Views from the Empire tract to the east permit an extensive panorama of the midtown Manhattan skyline, interrupted only the immediately proximate Transco tanks, and the Palisades ridge line on which the communities of North Bergen and West New York are located. Views to the west are limited by the commercial/industrial section of Carlstadt, but beyond this the residential section of Carlstadt appears as a low-rise community on a wooded ridge that reaches an approximately 200-ft elevation.

Aerial View of Site from North

Figure I L-1